San Francisco International Airport Environmental Impact Assessment Report Airport Improvement Program

Volume I

Landrum & Brown, Airport Consultants

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SAN FRANCISCO INTERNATIONAL AIRPORT

EXPANSION PROGRAM

ENVIRONMENTAL IMPACT ASSESSMENT REPORT

VOLUME I

Prepared by:

Landrum & Brown
Airport Consultants

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DESCRIPTION AND PURPOSE OF THE PROJECT

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DESCRIPTION AND PURPOSE OF THE PROJECT

Throughout its history, the U.S. air transportation industry has grown continuously, making ever greater contributions to the nation's economic well being and to the quality of life of much of its population. Growth of the national aviation system has been placed by continually rising demands for air transportation service, and while the rate of growth of demand has varied over the years, it has nevertheless been virtually uninterrupted.

This history of continuous, uninterrupted growth has made it clear that the operators of the nation's public airports have a continuing responsibility to maintain a vigilant watch on trends in the public demand for air transportation service, and to plan and develop the airport facilities required to provide that service.

Essentially, this statement has been prepared for the purpose of fulfilling the requirements of the National Environmental Policy Act (1969) necessary for the federal funding of a part of the expenses to be incurred in the further development of the San Francisco International Airport. Under authority of the Airport and Airways Development Act of 1970, the Federal Aviation Administration may provide matching funds on eligible improvement projects, generally associated with runways, taxiways and aircraft aprons.

The City is seeking reimbursement funds under ADAP (Airport Development Aid Program). This is a program of allocating trust fund monies generated by tax revenues from aircraft fuel sales, equipment sales, and airline ticket sales under the administration of the FAA.

This chapter describes the forward thinking done by those responsible for the continuing development and operation of San Francisco International Airport (SFIA). Specifically, it describes the proposed expansion program for San Francisco International Airport (SFIA) and presents background information related to the project. The remainder of this chapter is divided into sections entitled:

- Project Purpose
- Project Description
- Airport Site
- Community Data and Environmental Setting

Subsequent chapters of this Environmental Impact Assessment Report (EIAR) discuss the social, economic and environmental consequences of both a decision to proceed with the project, and alternatively, a decision not to proceed (i.e., the "do nothing" alternative).

To provide a firm basis for understanding all that follows in this EIAR, it is appropriate at this point to emphasize some fundamental truths about aviation in the United States that underlie the various analyses discussed in later chapters. These include the following:

- Airport facilities do not induce demand for air transportation services, communities do. Evidence is abundant throughout the history of U.S. aviation that airports are only economically viable when they are located in close proximity to a bona fide market for air transportation service. Evidence is also available demonstrating that when airport facilities are built at great distances from an existing market (in the hope that new facilities will induce demand) such airports tend to be severely under utilized. A primary example of this fact is the comparison of the two Washington, D.C. airports Washington National and Dulles. Dulles has not lived up to its expectations because of its market relationship.

- Air carriers and air passengers have an unbelievably high tolerance for congestion and delay at airports. Again, there is abundant evidence throughout the U.S. to support the contention that deficient facilities are not an effective way to inhibit the growth of aviation demand at an airport.

Thus, the issue addressed in this EIAR is not whether the community should allow the demand for air transportation service at SFIA to grow as forecast. On the premise that the community itself will remain the vital, prosperous entity it is today, it is virtually a certainty that demand for air transportation will also grow no matter what course of action is taken at SFIA. Rather, the issue addressed herein is whether it is in the community's interest to accommodate the growing air transportation demand with adequate facilities at SFIA.

1. PROJECT PURPOSE

Briefly, the proposed project includes the following major elements:

- Improvements to the Existing Terminal Building
- Addition of New Boarding Areas and Apron[1/]

1/ This EIAR has been prepared specifically in support of an application (ADAP-08) for federal funds to construct boarding aprons for the North Terminal and to relocate taxiways S and SS. Future projects which are eligible are also included.

- Addition to the Existing Parking Garage
- Modifications to the Existing Airfield Apron and Taxiway System[1/]

The proposed project was not hastily conceived. Planning for the project has been underway for several years. The key events in that planning history are identified below, followed by a description of the elements of the project itself.

(1) Master Planning and System Studies

Motivated by its responsibility to assure that the facilities at the airport are at all times adequate to provide high quality service to its users, SFIA management has conducted a continuing program of facilities evaluation and planning. The most recent master planning effort was started in 1967 because of crowding conditions in the terminal building. This plan, which was completed in 1969, recommended a four stage expansion program for SFIA.

More recently, there have been a number of airport system studies in the Bay Area. These studies were intended to determine the best means for providing air transportation services to meet the needs of the entire Bay Area. These studies recognized that each airport in the region is but one element in a complex system and that each airport must play its assigned role in that system or the entire system will be jeopardized. Three studies worthy of mention are:

1/ This EIAR has been prepared specifically in support of an application (ADAP-08) for federal funds to construct boarding aprons for the North Terminal and to relocate taxiways S and SS. Future projects which are eligible are also included.

- Bay Area Study of Aviation Requirements (BASAR)
- Regional Airport System Study (RASS)
- RASS II

The BASAR study was sponsored by the three Bay Area air carrier airports: San Francisco, Oakland, and San Jose. This study was the forerunner of the RASS studies, and laid the foundations for the later RASS work. In the RASS studies, numerous alternatives were considered for satisfying the Bay Area air transportation demand. Public hearings on the RASS I study were held throughout the nine county Bay Region during late 1971 and early 1972.

A preferred plan (essentially the recommended RASS I plan with some modifications) was adopted by the Metropolitan Transportation Committee responsible for the regional transportation plan in June, 1973. Basically, this plan confirmed the 1969 SFIA master plan and called for simultaneously developing all existing Bay Area air carrier airports to their ultimate capacity by 1985, resulting in activity levels as follows (expressed in terms of on and off passengers):

- San Francisco: 31 million passengers
- Oakland: 24 million passengers
- San Jose: 10 million passengers

Based on these recommendations and continuing surveillance of growth at the above three airports, the regional system plans and

the master plan for SFIA have been updated and amended as needed to be fully responsive to changing demands. As a part of this effort, there has been substantial interaction among SFIA management and airline industry representatives to assure that the proposed development program would properly serve the needs of the air carriers and the public.

In addition, there has been a high level of communication with the public about the proposed expansion program. To date, there have been seven public hearings. Recent events have included the following:

- A preliminary draft Environmental Impact Report (EIAR) issued January, 1973 responding to the California Environmental Quality Act.
- A public hearing in May, 1973
- A second draft of the EIAR, issued August 10, 1973
- A public hearing September 27, 1973
- A final draft of the EIAR and comments on October 11, 1973

Since the final draft EIAR, there have been additional comments regarding the proposed work; equally important, there have been revisions to passenger demand forecasts for the Bay Area. The most recent passenger forecast was adopted by the Regional Airports Planning Committee of the Metropolitan Transportation Commission on December 20, 1974 and it is this most recent forecast that was used in the various analyses reported in this EIAR.

(2) SFIA Facility Requirements

Determination of airport facility requirements involves an assessment of the capabilities of existing facilities to accommodate current and anticipated levels of traffic. As early as 1967, it was evident from assessments of this type that certain elements of the terminal building complex at SFIA were not adequate to handle the then current levels of traffic. As traffic levels continued to rise after 1967, the overcrowded conditions in the terminal became more severe and more widespread. Today, problems of facility deficiencies exist in the following areas:

- Passenger amenity areas such as:
  - rest rooms
  - restaurants
  - food service facilities
  - parking
- Baggage claim facilities
- Automobile parking facilities and terminal curb frontage
- Airline operations space and baggage makeup areas

The extent of new facility development that will be required in future years depends, of course, on anticipated levels of aviation demand. Aviation demand forecasts are thus, a crucial element of the environmental study reported in this EIAR, and are discussed in detail in Volume II, Appendix A, of this report.

Before presenting the forecasts it should be noted that throughout this EIAR, there will be found numerous discussions of passenger forecasts for SFIA. However, the numbers under discussion need to be examined with great care because several different types of passenger forecasts were made during the environmental study. To avoid misunderstandings, the following definitions should be remembered:

- True Origin and Destination (O&D) Passengers: Those passengers whose trips either originate or terminate at SFIA.
- Connecting Passengers: Passengers whose trips neither originate nor terminate at SFIA, but who transfer from one aircraft to another.
- Through Passengers: Passengers whose destination is not San Francisco, but who are aboard an aircraft that stops in San Francisco enroute to other destinations. These passengers generally do not get off the aircraft.
- Enplaning Passengers: The sum of originating passengers and connecting passengers.
- Deplaning Passengers: The sum of connecting passengers and those passengers whose destination is San Francisco.
- On and Off Passengers: The sum of enplaning and deplaning passengers.
- In and Out Passengers: The sum of on and off passengers and through passengers.
- Aircraft Operation: A landing or takeoff performed by an aircraft.

Generally, forecasting work is done in terms of either O&D or enplaning and deplaning (on and off) passengers. In the case

of SFIA, previous forecasts were developed for on and off passengers. However, the "in and out" passengers are basic to arriving and departing aircraft load factors, and it is these figures that contribute to development of aircraft operations forecasts, as discussed in Appendix A.

In analysis of terminal facilities, on and off passengers would be considered, because they are the ones that use the terminal building. For ground access analysis, however, the appropriate figures to use are those for origin and destination passengers, because these are the passengers who travel to and from the airport on the highway network. At SFIA, O&D passengers currently average about 88 percent of the on and off totals, with the remainder being connections. Consequently, one would not use the same set of figures for access studies as for terminal analysis.

To avoid confusion, this report and all its appendices present the forecasts in terms of total, or in and out passengers. For 1974, on and off passengers constituted approximately 92.6 percent of total in and out passengers, i.e., through passengers accounted for approximately 7.4 percent of total passengers. It was assumed that this relationship would hold true throughout the forecast period. In this study, whenever it was necessary to calculate the number of on and off passengers, the above relationship was used.

The forecasts of aviation activity are presented in Exhibit I-1. In reviewing these forecasts, it will first be noted that passenger demand is expected to double within the next twenty years. Consequently, the existing terminal facilities, already deficient in many areas, will become increasingly deficient as time passes.

The existing terminal building at SFIA provides approximately 360,000 square feet of space. Operating at an annual in and out passenger level of 17.4 million in 1974, this corresponds to 22.4 annual boarding passengers per square foot. In 1990, this ratio would increase to 42.4 annual boarding passengers per square foot, if no expansion is undertaken.

Other airports planned to operate at the 17-20 million passenger level have the following design ratios:

- Cleveland: 15.5 boarding passengers per square foot
- St. Louis: 14.3 boarding passengers per square foot
- Denver: 14.7 boarding passengers per square foot

Comparing these figures with the existing 22.4 ratio for SFIA clearly illustrates the current space deficiency.

EXHIBIT I-1

San Francisco International Airport

FORECASTS OF AVIATION DEMAND

PASSENGERS

Year	1974	1982	1990
Total In and Out Passengers	17,400,000	26,200,000	33,300,000
On and Off Passengers	16,200,000	24,400,000	31,000,000

OPERATIONS

Year	1974	1982	1990
Air Carrier Operations	287,490	291,400	285,100
Total Operations	334,000	367,640	361,340

In 1990, with 33,000,000 passengers, SFIA activity would be comparable to present traffic at Chicago-O'Hare, which is planned for a ratio of around 20 enplanements per square foot. These figures can be interpreted to mean that approximately a 30 percent increase in terminal size is needed just to solve today's problems, and that twice the amount of space available today will be needed by 1990.

As noted earlier, there are also deficiencies in existing parking and terminal curb front facilites. The analysis presented in Appendix C of this report indicates that during peak periods today, parking facilities are operating at almost 75 percent of capacity; and the deplaning curb front at the Central Terminal currently operates at approximately 18 percent over its practical capacity.

By 1990, if the proposed expansion program is not implemented, parking demand will exceed capacity by 25 percent; and terminal curb front demand will exceed practical capacity by 83 percent during peak conditions. As a result, there will be excessive double parking and severe disruption of traffic flow at the curb front. This situation will be compounded by unnecessary recirculating traffic resulting from a shortage of parking facilities.

Another point of importance in Exhibit I-1 is the fact that, while passenger traffic levels are expected to rise, the number of aircraft operations is not. In fact, noting that SFIA had a total of

386,674 aircraft operations in 1969, it is evident that total aircraft operations have been decreasing and will continue to decrease in future years. The reason this will occur is illustrated in Exhibit I-2, which portrays the fleet of aircraft that is expected to serve SFIA throughout the forecast period. From this exhibit, it can be seen that the percentage of wide-bodied aircraft 1/ serving SFIA is expected to increase steadily in the future.

Therefore, the total number of aircraft operations will decrease as the percentage of higher capacity, wide-bodied aircraft increases. Essentially, the increased passenger demand will be accommodated without an increase in annual aircraft operations because of the higher passenger capacity of the wide-body aircraft. For example, a DC-10 has an average seat capacity of 225 whereas a B-707 has a seat capacity of approximately 189. This represents a significant difference in load carrying capability per operation.

This dramatic change in fleet mix explains why airside facility expansion will also be required. The existing aircraft parking apron and passenger gate system at SFIA was not originally designed to accommodate the mix of aircraft indicated in Exhibit I-2. Consequently, gate spacing, hold room size and apron strength and general configuration do not lend themselves to smooth,

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1/ Wide-body aircraft are those aircraft whose gross weight exceeds 300,000 pounds, e.g., B-747, DC-10, L1011.

EXHIBIT I-2

San Francisco International Airport

AIRCRAFT FLEET MIX FORECAST

Code	Description	Typical Aircraft	1974		1982		1990	
			Percent	Total Operations	Percent	Total Operations	Percent	Total Operations
1	Four Engine Turbo Jet	B-707-120, 320; B-720; DC-8-20, 30; CV-880	3.24	10,823	1.17	6,993	1.19	4,305
2	Four Engine Turbo Fan & Four Engine "Stretch Fan"	B-707-120B, 320B; B-720B; DC-8-40, 50, 61, 62, 63	19.95	66,623	11,70	43,010	7.50	26,628
3	Three Engine Turbo Fan	B-727-100, 100C/QC	24.93	83,274	13.89	51,082	12.59	44,732
4	Three Engine "Stretch" Fan	B-727-200	(Combined with Code 3)					
5	Two Engine Turbo Fan	B-737; DC-9; BAC-111	19.28	64,414	22.81	83,864	20.89	74,211
6	Four Engine HBPR Fan	B-747	4.29	14,326	6.90	25,381	9.48	33,670
7	Two & Three Engine HBPR Fan	DC-10; L-1011; A-300B	4.19	14,016	22.05	81,070	27.96	99,330
8	Supersonic Transport	Concorde; TU-144	--	--	--	--	0.63	2,224
9	General Aviation Jet	Jetstar, Lear	0.74	2,493	0.68	2,493	0.69	2,493
10	Four Engine Trubo Prop	L-188; L-100; DC-6,7	1.75	5,830	1.35	4,965	1.37	4,965
11	Two Engine Turbo Prop, over 12,500 lbs.	CV-580, FH-227, M-404	2.74	9,149	1.22	4,488	1.24	4,488
12	Twin Engine Piston Prop Under 12,500 lbs.	310, Baron, Aero-commander 500, 421	8.28	27,669	7.59	27,669	7.62	27,669
13	Single Engine Piston Prop; STOL	172; Bonanza	3.41	11,383	3.10	11,383	3.13	11,383
14	Helicopter	S-61	7.18	24,000	6.87	25,242	7.60	25,242

efficient operations in the future. The situation will lead to delays as aircraft await gate availability, crowding, and severe passenger inconveniences. Moreover, because of the number of passengers they carry, baggage from the wide-bodied aircraft will cause problems in the inbound baggage claim areas, and in the outbound baggage makeup areas. These problems will also be felt at the curb front, as discussed earlier.

Therefore the purpose of this airport expansion is to accommodate the current and future passenger demand at SFIA. The airport expansion will include passenger terminal and parking development and airfield improvements to accommodate the changing fleet mix of aircraft that will carry the increasing numbers of passengers. This proposed airport expansion will enable SFIA to fulfill its designated regional role of accommodating 33 million annual passengers (in and out).

* * * * *

When the airport first began operations at this site in 1927, it was in a relatively isolated area. Now, over 48 years later, San Francisco International Airport has become the major commercial airport in the Bay Area, serving both local residents and visitors from all over the world. To fulfill this role, SFIA management has aggressively pursued a program of planning and orderly expansion. The objectives of this continuing program have been to provide the best possible service to the community with minimal disruptions.

It is within these guidelines that the proposed expansion program was developed. Details of the program are presented in the sections that follow.

2. PROJECT DESCRIPTION

In this section, the details and purpose of the proposed development program are discussed. The project description is organized into the following three components:

- Summary of the development progress to date
- Detailed descriptions of short term improvements (to 1980)
- Descriptions of long term improvements (to 1985)

(1) Progress To Date

The proposed development program may be best understood if some recent construction history is first reviewed. Exhibit I-3 depicts the current airfield and terminal facilities at SFIA, and Exhibit I-4 lists many of the significant projects completed in the past five years. The progress in construction is shown in ten different areas: terminal buildings, cargo buildings, gate facilities, auto parking, vehicular roadways, aprons and taxiways, airfield area, navaids, utilities and other areas. Some of the more significant projects are discussed below.

- Foundations for the North Terminal. Construction of the 160,000 square-foot basement structure, including first-level slab, for the foundation for the North Terminal, with utilities roughed in, was completed for the first phase in 1973. The remaining work on the basement foundations is nearing completion.

MAP OF

San Francisco International Airport

City & County of San Francisco
Airports Commission

William J. Dwyer – Director of Airports

1973

RA-10594 Rev. 7 (

Terminal Buildings

- Foundations for the North Terminal Structure

Cargo Facilities

- Construction of Cargo Building No. 7

Passenger Boarding Facilities

- Boarding Area A

Auto Parking

- Fifth Level Addition to Garage

Vehicular Roadways

- Entry Roads Including West Underpass
- Terminal Roads and East Underpass

Other

- Noise Monitoring System

Aprons and Taxiways

- Taxiway B and Apron
- Extension of Taxiway B and Apron
- Taxiways G and L
- Addition to South Terminal Apron
- Boarding Area A Apron
- Centerline Taxiway Lighting - Taxiways B, D, E, F, and G

Land Development

- Fill West of Bayshore
- North Airport Fill

Airfield Area

- Extension of Runway 28R
- Hi-Speed Exit for Runway 19L

Navaids

- Relocation of Remote Transmitter Facility
- Preparation of Localizer for CAT III
- Trestle for Runway 28L -- approved lighting

Utilities

- Construction of West Bayshore Power Substation
- Construction of Secondary Sewage Treatment Plant
- Extension of Effluent Lines to Sewage Treatment Plant
- Provision of Power, Water, and Telephone Services to Sewage Treatment Plant
- Replace Sanitary Sewers
- Stand-By Power Generation Unit at at the Sewage Treatment Plant
- Effluent Link from the Sewage Plant to a Deep Water Sanitary Outfall

EXHIBIT I-4

San Francisco International Airport

RECENT CONSTRUCTION PROGRESS

- Boarding Area A. A part of the South Terminal included construction of the 200-foot diameter, three-level rotunda-shaped boarding area for international passengers. It is partially enclosed at ground level, fully enclosed at the second and third levels, and finished in public use areas. Including the first bay of the connecting concourse, it provides over 74,000 square feet of enclosed space.

- Apron and Taxiway Projects. These projects provide for greater maneuverability of the new, large high density aircraft through increased apron and/or taxiway area. Lighting improvements were also made, in accordance with FAA criteria.

- Extension of Runway 28R. This project, started in August, 1967, extended Runway 28R and its parallel taxiway approximately 2,500 feet to the east. The extension provides the runway system with capability for accommodating the lowest landing weather minimums.

- Construction of West Bayshore Power Substation. This power substation, located west of Bayshore and south of the San Bruno interchange, provides additional power for the airport and also serves as a backup major power service to the main airport substation located adjacent to the airport entrance.

- Sanitary Sewage Treatment Plant. The new 2.2 mgd secondary sewage treatment plant north of the seaplane harbor, was constructed to meet new effluent quality standards and to prepare for the future demands.

- Noise Monitoring System. Noise monitoring equipment is being installed north and south of the airport to monitor noise made by aircraft upon arrival and departure.

(2) Proposed Project Development for the Short Term (1980)

The following projects are identified to fulfill short term (until 1980) needs. Exhibit I-5 outlines graphically the short term project proposals. A complete listing of the short term projects is shown in

EXHIBIT I-5

San Francisco International Airport

SHORT-TERM EXPANSION

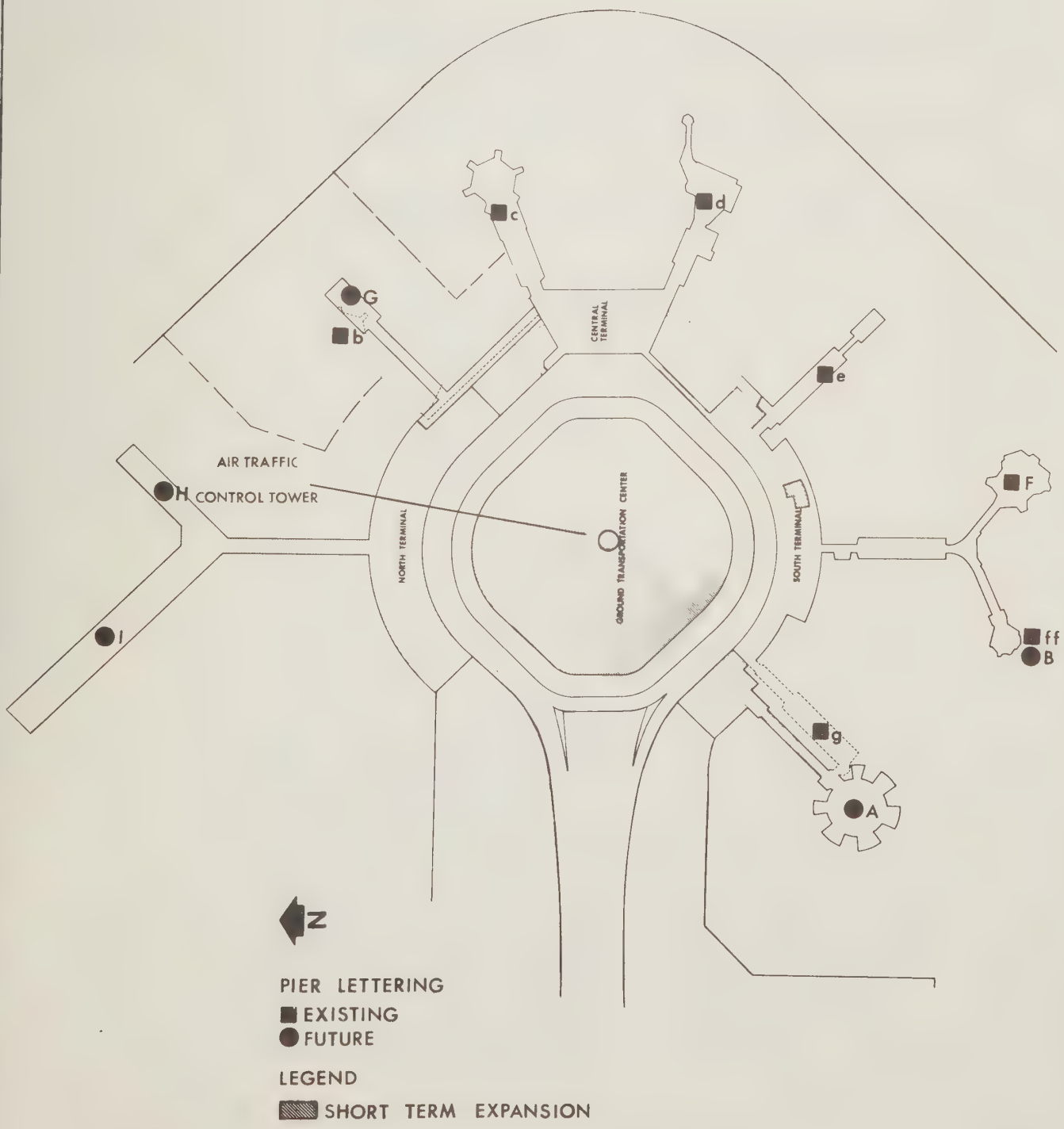


Exhibit I-6. More simply stated, however, the short term proposed development is comprised of the following:

- Completion of the North Terminal structure by 1978
- Replacement of Pier B with new Pier G and connector by 1979
- Completion of the Ground Transportation Center by 1978 including a new air traffic control tower
- Construction of the west addition to the South Terminal by 1979
- Construction of the east addition to the South Terminal by 1979
- Vehicular roadway projects
- Airfield projects
- Utilities improvements
- Other projects

Each of these projects is discussed in further detail below:

1. Completion of the North Terminal Structure.

The North Terminal Structure is divided into five projects and will not be usable until all of them are completed. These include foundations, structures, aprons, remote boarding areas and the Central Heating and Cooling Plant. The boarding areas are vital, since the aircraft service facilities for the entire terminal are located under them. The facility was approved by the Airport's Commission on October 20, 1970 and construction began with the award of the contract for the foundations on February 2, 1971. That $6 million contract was 98 percent complete on July 1, 1973. During construction of foundations, design has proceeded on other phases of the facility. Four projects are yet to be completed:

EXHIBIT I-6

San Francisco International Airport

PROPOSED SHORT TERM (1980) DEVELOPMENT PROJECTS

Terminal Buildings

- North Terminal Structure
- South Terminal West Addition and Connector to the International Boarding Area
- South Terminal East Addition
- Landscaping of Entrance Roads

Boarding Area

- Boarding Area H and I and Connector to the North Terminal
- Northeast Frontal Gates
- Southeast Frontal Gates
- Boarding Area G and Connector to the North Terminal

Auto Parking

- Parking Garage Addition
- Existing Garage Modifications
- Southeast Court Parking Deck

Vehicular Roadways

- Increase Frontage Roads to Four Lanes
- North Access Road

Aprons and Taxiways

- North Terminal
- Extend Taxiways A and B to Runway 10R
- Realignment and extension of Taxiway C
- Reconstruction and overlay of Taxiways S and SS (part of North Terminal Apron project)
- Lighting for Taxiways F, G, E, L, N, P, and V.

Airfield Area

- Hi-Speed Exit - Runway 28R
- Runway Drains 28R, 28L, 19R, and 19L
- Overlay of 28L

Navaids

- Control Tower and Ring

Utilities

- Central Heating and Cooling Plant
- Industrial Waste Plant with Force Mains and Pump Station
- West of Bayshore Utilities and Roads - First Phase
- Expansion of Power Station TA and Utility Distribution

Other

- New Field Lighting Building
- Interline Baggage Tunnel
- Accommodation for BART Access
- Replacement of Fire-Crash Building
- Automatic Control Equipment
- Acquire Standard Oil Hangar
- Cargo Area Improvements
- Demolition of Hangar FT
- Relocation of the Air School

- The North Terminal building completion encompasses finishing and extension of each end of the basement under frontal gates and extension of the building basement at the west end; construction of the complete three-level superstructure, canopy and roof designed for parking; construction of two pedestrian bridges and two tunnels connecting the Superstair Complexes to the garage, with provision for moving walkways on the bridges; construction of a service road beneath the frontal gate holding room along the full length of the North Terminal; and construction of sidewalk structures.

- Boarding areas H and I will provide 15 aircraft loading positions for the North Terminal. Located in the hub of Boarding area H-I is an information counter for passenger assistance and boarding gate information. Area H-I will also have a large public circulation area, including a restaurant, bar, and public seating. The building is essentially two stories high with mechanical rooms and a nominal amount of tenant lease space at the third level. Aircraft boarding, gate lounges, and related activities will be located on the second level. The apron level will be restricted to use by the airlines and airport operations.

- The north terminal aprons provide for aircraft parking positions at passenger boarding areas H and I. Included in this project is the relocation of taxiways S and SS to provide proper separation between aircraft on parallel taxiways.

- Frontal gates between the Central Terminal and the North Terminal will consist of second-level frontal gate holding rooms and concourses with a service road beneath frontal gate holding rooms on a structural slab.

2. Replacement of Pier B with Pier G and Connector

This project involves construction of a second-level satellite boarding area, providing approximately 29,000 square feet of enclosed space. There will be a 400-foot long, second-level connector to the North Terminal with provision for moving walkways.

3. Completion of Ground Transportation Center.

The Ground Transportation Center phase of the central parking concept is planned to be constructed in a series of separate contracts, with completion anticipated in 1979. The existing garage is to be modified and enlarged around a central open space, the focal point to be the FAA tower, with a landscaped plaza at its base. A central high temperature and chilled water plant will be located in the garage structure. The three major elements of the Ground Transportation Center -- the garage, the central plant, and FAA tower -- are described below.

Construction of a five-level addition to the existing garage is planned, increasing the parking capacity to a total of 7,300 cars; including construction of two automobile ramps for vertical circulation between all levels. This also includes installation of a parking and traffic monitoring and control system to assure maximum utilization of parking facilities, and construction of four vertical pedestrian transportation cores. The garage addition will also contain structural provisions for future construction of an elevated track at the sixth level for a People Mover System, and stations initially serving garage patrons destined to and from the North and South terminals, Boarding Areas H and I, Boarding Area G and Boarding Area A.

Modifications to the existing garage are necessary to accommodate addition of the new structure and to integrate the vertical transportation cores with the revised passenger transportation concept. This includes modifications of existing vertical pedestrian transportation cores and replacement with three new stair and elevator cores, removal of existing automobile ramps, removal of existing exterior screen and replacement with balustrade facade to match the new addition. There will be additional structural modifications as necessary to accommodate the remodeling.

Modification of the existing garage will also provide increased strength in the existing structure to permit installation of the sixth level of People Mover Systems and stations serving the South Terminal and Boarding Areas B-C, Boarding Area D, the Central Terminal and Boarding Areas E-F. Structural provisions also include foundations for BART lines and station below the first level.

A perimeter baggage/utility tunnel below the first-level slab of the garage will accommodate utility distribution mains from the central supply facilities and possible future installation of an interline baggage system.

A combined central heating and cooling plant is planned for construction in the new garage addition to serve the entire terminal area. From this plant, high temperature hot water and chilled water will be piped to heat exhangers in the terminal buildings.

A new FAA control tower will be constructed in the center of the Ground Transportation Center. In addition to the FAA control cab and support equipment, there will be administrative and maintenance facilities for FAA at the ground level. The project will also include demolition of the existing control tower and necessary refinishing of areas disturbed.

4. Completion of the west addition to the South Terminal.

Extension of the South Terminal Building from the existing wall westward will provide a Superstair Complex for Boarding Area A and an additional 63,000 square feet of public use and rentable space. This facility would be used by U. S. Customs, U. S. Immigration Service, U. S. Health, Education and Welfare, and U. S. Agriculture Department.

5. Completion of the east addition to the South Terminal.

Extension of the South Terminal building from existing east wall eastward will include construction of additional basement, ground, second and third levels; construction of a pedestrian bridge and a tunnel connecting the Boarding Area D Superstair Complex with the Ground Transportation Center, with provision for moving walkways; construction of a sidewalk-canopy structure to Central Terminal building; and construction of sidewalk between the terminal and terminal roads at upper and lower levels for the length of the extension.

The southeast court parking deck will provide for construction of a temporary second-level parking structure in the present Southeast Court, providing approximately 35,000 square feet of parking space for short-term terminal parking.

Frontal gates between the Central Terminal and the South Terminal east addition will complete the east addition to the South Terminal. It will consist of second-level frontal gate holding rooms and concourse, with a service road on a structural slab beneath.

6. Vehicular Roadway Projects [1/]

Three projects in this first short term plan relate to vehicular improvements. They include:

- intersection improvements and reconstruction of the frontage roads between Millbrae Avenue and San Bruno Avenue to increase capacity to four lanes throughout
- construction of a new road to service the new property created by the north airport fill
- provision of utilities and roads necessary for development of the property prepared as a result of the fill west of Bayshore

7. Airfield Projects.

These include:

- provision of a high-speed exit taxiway from extended Runway 28R to increase the runway landing acceptance rate
- provision of pump stations and discharge lines to pump drainage water from Runway 28R and 28L into the Bay, replacing the present gravity drainage system, which has proved inadequate during high tides

1/ A related project is the completion of Interstate 380 with special airport access roadways.

- overlay of runway 28L for safety reasons (Because of settling, it is necessary to re-level the surfaces of the entire airfield every two to three years.)

- extension of Taxiways A and B to the western limit of Runway 10R to improve taxiway circulation and permit use of full length of the runway

8. Utility Improvements.

These include:

- construction of a water treatment plant (designed to produce an effluent meeting standards of the Water Quality Control Board) in the north airport fill area to treat industrial wastewater from aircraft washing bays, apron and similar areas

- construction of pump stations and pressure pipelines required to pump industrial wastewater from catch basins to the industrial waste treatment plant

- installation of utility mains from central supply facilities to terminal facilities

9. Other Projects.

These include:

- replacement of No. 1 Crash House to accommodate new requirements for fire-crash equipment and manpower

- control systems for sensing and automatically reporting to a central control room conditions of security, fire control systems, communications systems, noise abatement, and airfield and road lighting

- acquisition of the Standard Oil hangar adjacent to Cargo Building No. 7

(3) Proposed Project Development for the Long Term (1985)

Following is a discussion of the projects related to fulfillment of long term aviation needs at San Francisco International Airport. Long term projects are scheduled for completion by 1985.

Exhibit I-7 shows the relationship of the long term projects to existing facilities of San Francisco International Airport. Exhibit I-8 gives a complete listing of long term projects. For discussion purposes, these projects are identified as:

- Central Terminal modifications
- Construction of Boarding Areas E and F
- Construction of Boarding Area D
- South Terminal modifications

Each of these projects and their components are discussed in greater detail below:

1. Central Terminal modifications.

Remodeling and additions to the Central Terminal to improve passenger and baggage handling facilities include:

- addition of frontal gates on the airfield side to match new construction and minor exterior remodeling

EXHIBIT I-7

San Francisco International Airport

LONG-TERM EXPANSION PROJECTS

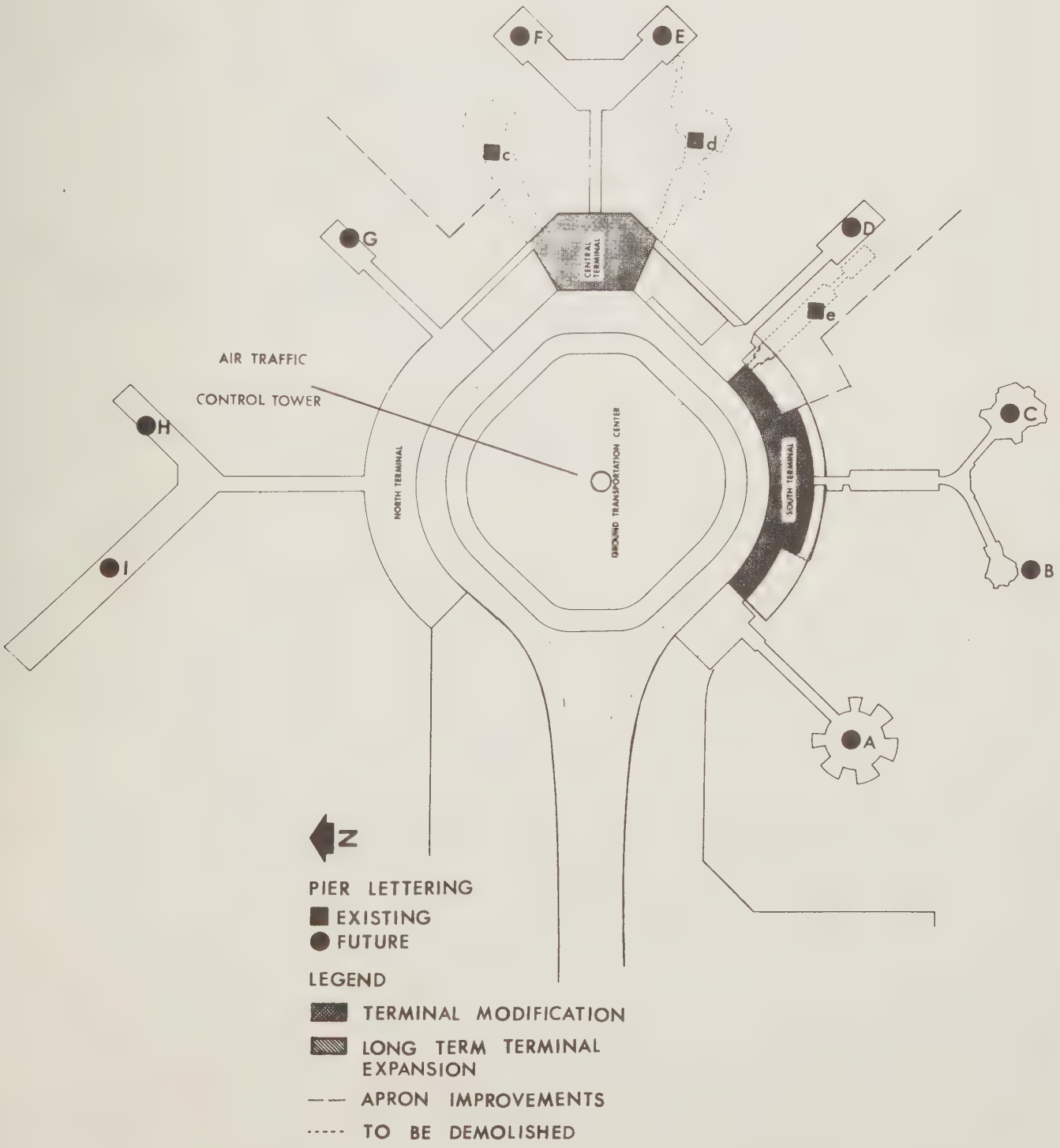


EXHIBIT I-8

San Francisco International Airport

PROPOSED LONG TERM (1985)
DEVELOPMENT PROJECTS

Terminal Buildings

- Central Terminal Additions and Modifications
- South Terminal Additions and Modifications
- People Moving System Loop and Equipment

Boarding Area Facilities

- Boarding Area E - F and Connector
- South Terminal Frontal Gates
- Boarding Area D and Connector

Auto Parking

- Northeast Court Parking Deck

Aprons and Taxiways

- Central Terminal Aprons
- South Terminal Aprons
- Boarding Area B Apron

- construction of a pedestrian bridge connecting the Central Terminal Superstair Complex with the Ground Transportation Complex, with provision for moving walkways

- construction of a Superstair Complex including necessary structural alterations to receive the pedestrian bridge from the Ground Transportation Complex, with provision for moving sidewalks

- remodeling of existing pedestrian tunnel to the Ground Transportation Complex

- general remodeling of first, second, and third levels to new terminal standards (excluding structural alterations for airline automated baggage handling equipment)

- provision for construction of temporary second-level parking structure in the present northeast court, providing approximately 35,000 square feet of parking space for short-term terminal parking

- reconstruction of the aprons along the southeast, central and northeast terminals to provide for the frontal gate positions and for the new Boarding Areas E and F

2. Construction of Boarding Areas E and F.

This project will include construction of a second-level central concourse and two second-level satellite boarding areas, providing approximately 67,000 square feet of enclosed space. There will be a new 400-foot-long second-level connector to the Central Terminal with moving sidewalks.

3. Construction of Boarding Area D.

Construction of second-level satellite boarding area D will provide approximately 29,000 square feet of enclosed space. There will be a 400-foot-long second-level connector to the South Terminal with moving sidewalks.

4. South Terminal Modifications.

Modifications to the South Terminal are composed of three parts -- remodeling of the interior, apron reconstruction, and terminal additions and frontal gates. These are described below:

- remodeling of the interior includes construction and finishing of the Boarding Area B-C Superstair Complex, necessary structural alterations to receive the pedestrian bridge from the Ground Transportation Center; remodeling of the existing pedestrian tunnel to the garage structure; conversion of space vacated by the steam plant to operations or rental areas; general remodeling of finish and mechanical and electrical work to new terminal standards (excluding any structural alterations necessary for airline automated baggage handling equipment) and modification of facade to match the North Terminal

- reconstruction of the aprons along the South Terminal building will provide for the frontal gate positions and for the new Boarding Area D

- the South Terminal additions and frontal gate project encompasses construction and finishing of basement, first, second, and third levels; and construction and finishing of frontal gate holding rooms and frontal gates at second level; and construction of service road on a structural slab beneath the frontal gate holding rooms along the full length of the South Terminal

* * * * *

This completes the description of the proposed expansion plans. Exhibit I-9 shows the final planned configuration of the terminal area.

3. AIRPORT SITE

San Francisco International Airport is located 15 miles south of downtown San Francisco, in San Mateo County on the west shore of San Francisco Bay. Exhibit I-10 shows the airport site in the Bay Area. Most of the airport property to the north, east and south abuts San Francisco Bay. The Bayshore Freeway, Highway 101, closely approximates the airport's west property boundary.

The largest of three air carrier airports serving the Bay Area, SFIA is operated by the Airports Commission of the City and County of San Francisco.

4. COMMUNITY DATA AND ENVIRONMENTAL SETTING

San Francisco International Airport is the major airport in a large urban area and serves a major air transportation demand. As a regional airport, its zone of influence extends through much of Northern California and into Nevada. The nine-county region of the Association of Bay Area Governments (ABAG) includes the communities adjacent to the airport plus many others. The population of this nine-county area is shown below.

EXHIBIT I-9

San Francisco International Airport

FINAL TERMINAL CONFIGURATION

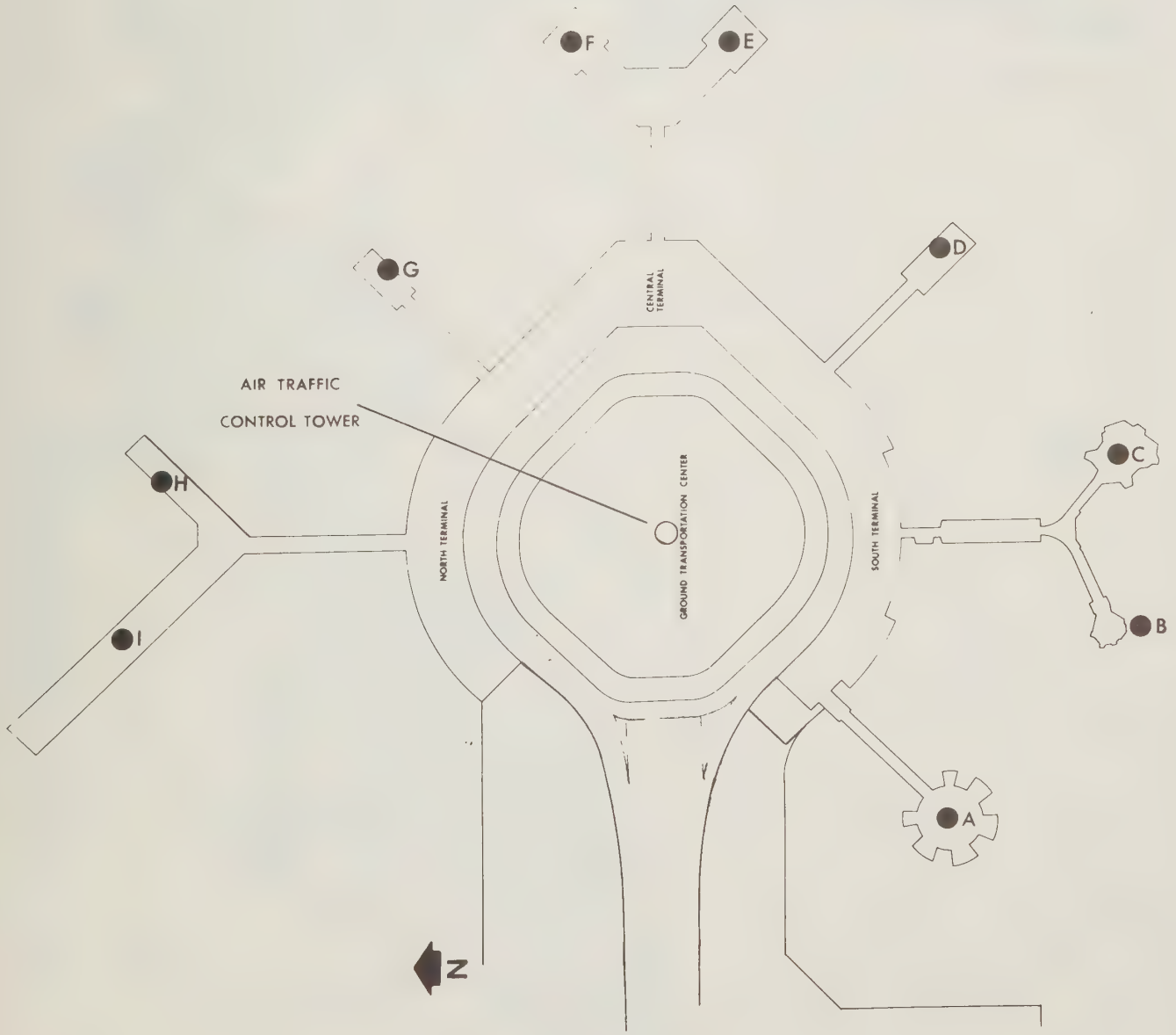
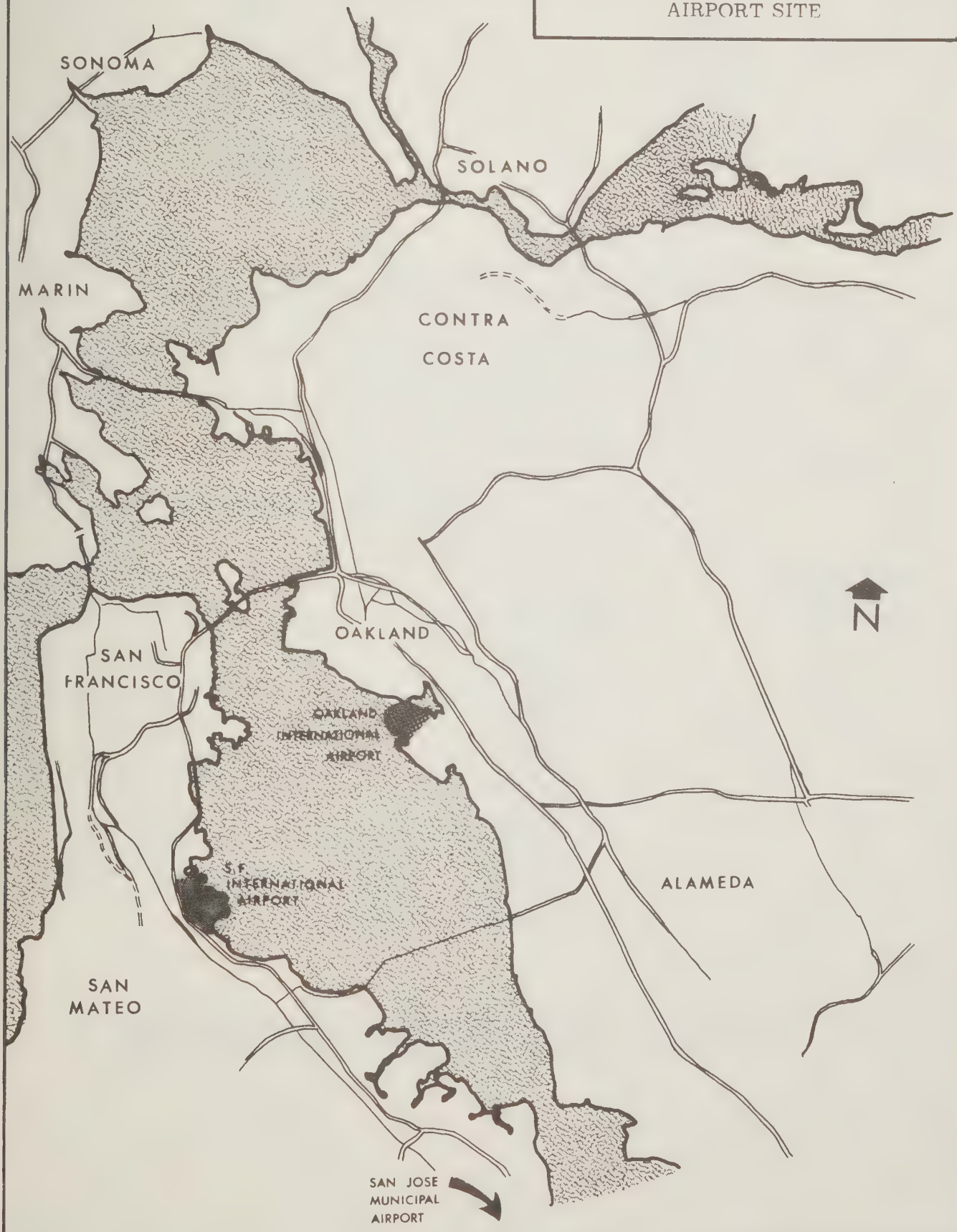


EXHIBIT I-10

San Francisco International Airport

AIRPORT SITE



County	1973 Population [1/]
Alameda	1,095,700
Contra Costa	581,200
Marin	215,700
Napa	85,200
San Francisco	687,900
San Mateo	569,400
Santa Clara	1,159,600
Solano	183,800
Sonoma	231,600
TOTAL	4,810,100

The communities of Millbrae, South San Francisco, San Bruno and Burlingame, as shown in Exhibit I-11, are adjacent to SFIA property, and Exhibit I-12 depicts surrounding land uses. The 1970 population of these and other adjacent communities are shown below. The table also shows the approximate mileage to these cities.

Community	1970 Population	Mileage From SFIA
Brisbane	3,003	5
Burlingame	27,320	2
Daly City	66,922	8
Foster City	9,522	9
Hillsborough	8,753	4
Millbrae	20,920	1
San Bruno	36,254	3
San Mateo	78,991	10
South San Francisco	46,646	3
TOTAL	298,331	

1/ Population Estimates for California Counties, Population Research Unit, Department of Finance, Sacramento, California - August 1, 1974.

EXHIBIT I-11

San Francisco International Airport

NEIGHBORING COMMUNITIES

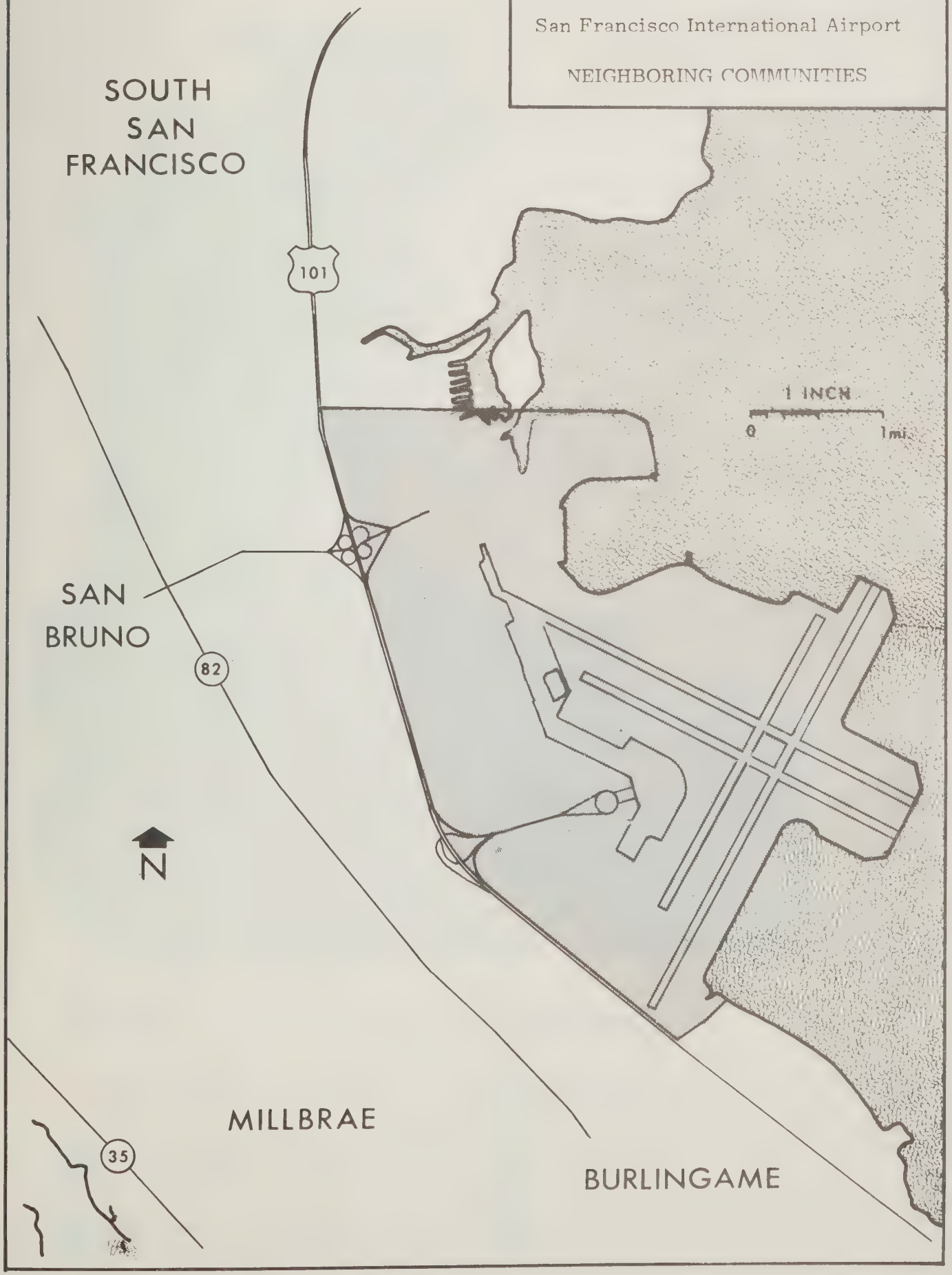
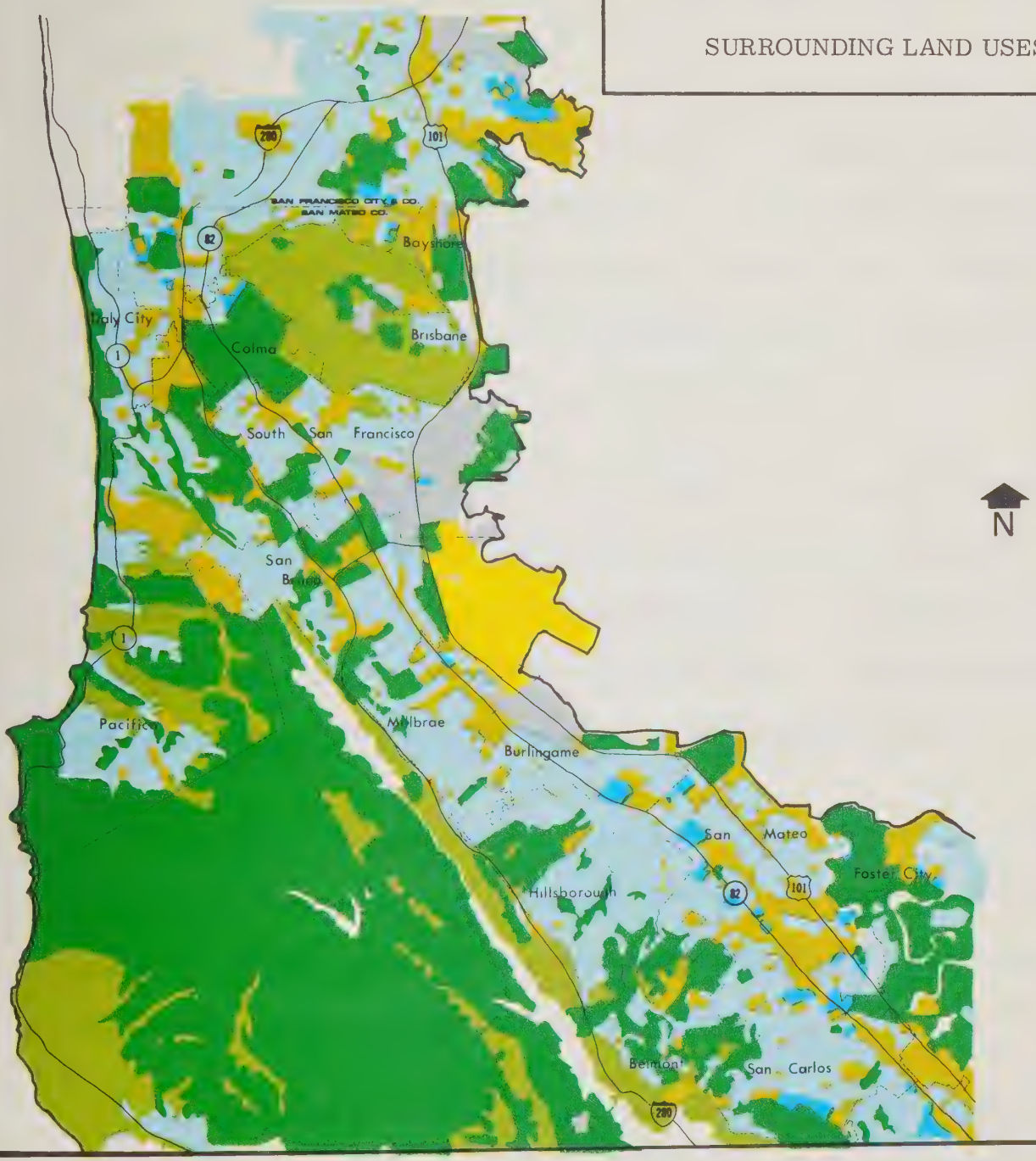


EXHIBIT I-12

San Francisco International Airport

SURROUNDING LAND USES



LEGEND

- San Francisco Intl. Airport
- Single Family Residential
- Multi-Family Residential
- Commercial
- Industrial
- Agriculture
- Open Space

All the expansion program will take place within existing airport boundaries. As a result, this proposed program will not divide or disrupt local communities or individual land uses.

The regional environmental setting of SFIA may be considered generally as the area surrounding the Bay of San Francisco. The 450-square-mile San Francisco Bay lies in a valley between ranges of mountains and opens to the Pacific Ocean through a relatively narrow passage at the Golden Gate. Earthquake fault lines traverse the area on each side of the Bay.

San Francisco Bay is a unique body of water that has many diverse uses. It is used for commercial and recreational purposes, such as shipping, fishing, and boating, as well as being a breeding ground for several varieties of fish. There are shallow waters immediately east of the airport, which move by tidal action across mud flats and bring water and minerals to plants and fish.

Wild plants and animals abound in the San Francisco Bay region. Over 1,000 different kinds of higher plants and several hundred birds and mammal species are present. If all invertebrates were included, the list of animal species would probably run into the tens of thousands.

The climate of the coastal areas is tempered by winds from the Pacific and these areas usually have cool summers and warm winters. Snow is nearly unknown in most of the nine counties of the Bay Area. Rainfall varies within the Bay Area, with San Francisco International Airport having an average rainfall of almost 19 inches.

The area is served by major north-south and east-west freeways. The Southern Pacific Railroad serves the San Francisco Peninsula with commuter trains and freight trains. A new 75 mile rapid transit system serves a portion of the Bay Area local traffic. Lines run from Concord and Fremont into Oakland and then across the Bay into San Francisco and on to Daly City. This system may in the future be extended from Daly City down the peninsula. Should this materialize, there would be a main line station under the terminal at San Francisco International Airport.

* * * * *

This chapter has dealt with the reasons for the proposed program, a detailed description of the program itself, and the general setting of San Francisco International Airport. It was within this general framework that the analysis was conducted and succeeding chapters of this report describe the impacts of the pro-program.

CHAPTER II

PROBABLE IMPACTS ON THE ENVIRONMENT

CHAPTER II

PROBABLE IMPACTS ON THE ENVIRONMENT

The proposed SFIA terminal expansion project involves activities which will have both temporary and permanent effects on the human and natural environment. Every effort has been made in planning the project to minimize these effects and similar efforts will be made during project implementation.

This chapter describes the probable impacts (both positive and negative) on the SFIA area environment that would result from a decision to proceed with the project, and alternatively, from a decision not to proceed with the project.

1. INTRODUCTION

The temporary effects of the proposed terminal expansion project are principally related to construction activities. These include impacts on air, water and noise pollution as well as solid waste disposal. These temporary effects will generally prevail throughout the construction phase of the project, but will cease to exist after construction is completed.

The construction phase will be carried out in full compliance with FAA's Advisory Circular 150/5370-7, "Airport Construction Controls to Prevent Air and Water Pollution." Temporary air quality impact will result from the discharge of airborne pollutants from the operation of construction machinery, and from dust generated by earth moving equipment. Potential for adverse

air quality impact will be minimized through implementation of measures outlined in FAA Advisory Circular 150/5370-6, Sections 4, 5 and 6. Potential for water pollution during construction from sources such as siltation, erosion, sedimentation, wash water, detergents and solvents, fuel and oil spillage, surface runoff and grading, will be minimized as outlined in FAA Advisory Circular 150/5370-6, Section 7 and 9. Finally, appropriate measures will be taken to minimize the temporary impact of noise pollution caused by the construction program.

The areas of potential permanent impact on the human and natural environment that were analyzed to support preparation of this EIAR include the following:

- Noise Exposure
- Ground Access
- Air Pollution
- Water Pollution
- Geological Aspects
- Wildlife, Marine Life and Conservation Areas
- Fuel and Energy
- Solid Waste Management
- Aesthetic and Visual Aspects
- Recreational, Cultural and Historic Areas
- Compatible Land Use and Community Distruption
- Economic Aspects

In general, the probable environmental impacts discussed in this chapter are based on forecast conditions at SFIA for the following six scenarios:

Year	Total Passenger Demand	Total Aircraft Operations	Airport Configuration
1974	17,400,000	334,000	Existing
1982	26,200,000	367,640	No Further Development
1982	26,200,000	367,640	Proposed Development
1990	33,000,000	361,340	No Further Development
1990	33,000,000	361,340	Proposed Development Without BART
1990	33,000,000	361,340	Proposed Development With BART

As discussed in Chapter I and noted in the table above, air travel demand at SFIA can be expected to be the same in future years whether or not the proposed terminal complex expansion is implemented. Thus, it is literally true, that for the majority of the areas of concern listed above, there will be little or no difference in probable impacts whether or not the proposed project is implemented. Recognizing, though, that while it may not be relevant to a go or no-go decision on the terminal complex expansion, the assessment of each of these areas is nevertheless of some interest.

In general, air transportation demand at a major hub airport is influenced very little by the quality of the airport's facilities. In the main, national and local economic conditions determine the levels of demand for air transportation. Thus, certain probable impacts on the environment will occur in virtually the same way whether or not the proposed expansion project is undertaken, and it is extremely important to keep firmly in mind that these impacts are not the consequences of the proposed project but are rather the by-products of a growing and prospering Bay Area.

2. NOISE EXPOSURE

As discussed in the introduction to this chapter and in Appendix A of Volume II, the level of aircraft activity at SFIA can be expected to be the same in future years whether or not the proposed terminal complex expansion is implemented. Thus, the proposed project will have no additional impact on community exposure to aircraft noise in future years. Nevertheless, a noise exposure analysis was carried out to satisfy public conern.

(1) Approach

Noise impact due to aircraft operations at SFIA was evaluated for existing conditions (1974), as well as for forecast 1982 and 1990 conditions. In addition, the effect of seasonal wind shifts was evaluated for each of the three years analyzed. Thus, the results are presented in terms of annual ("typical") and seasonal ("worst-case") noise exposure.

Two noise descriptors were used to analyze the noise impact, the Community Noise Equivalent Level (CNEL) as required by California law and the Aircraft Sound Description System (ASDS) as required by the FAA. These two techniques are quite different in concept but share a common feature in that both begin by describing the noise environment in terms of noise exposure due to a single flyover.

The approach taken in evaluating noise impact was to relate noise exposure to various land uses and population. This approach provides meaningful criteria which in turn can be used to judge relative noise impact.

The criteria for measuring noise impact consisted of four parameters:

- Acres of land (in various zoning classifications) within various noise contours
- Number of residences within the various noise contours
- Number of people living within the various noise contours
- Number of schools within the various noise contours

The California legislation dealing with noise impact around airports was used as a guideline in assessing land use compatibility. This law prescribes land use categories that are compatible with predefined noise levels. The compatible land uses are:

- Agricultural property
- Airport property
- Industrial property
- Commercial property
- Property subject to an avigation easement for noise

- Zoned open space
- Acoustically treated high rise apartments
- Existing single family homes that are acoustically treated.

Land use data were collected from the communities surrounding SFIA and, in addition, a regional land use map, derived from the Atlas of Urban and Regional Change, was examined. The categories of land use were condensed into seven classifications:

- Single-family residential
- Multi-family residential
- Agricultural
- Commercial
- Industrial
- Open space
- Airport

The impact of noise upon land use was calculated by overlaying the noise contours on the land use map and determining the acreage of each land use within each noise contour.

Population and residence data were obtained from ABAG/MTC forecasts. These data project population, dwelling units, employment, acres of urbanized area, residential area, and unusable area for 290 zones in the Bay Area. From the population and residence forecasts, two parameters were calculated and

were used in conjunction with land use analysis to provide estimates for population and residences within various noise contours. The two parameters were:

- Dwelling units per residential acre
- Persons per dwelling unit

In general, the noise impact assessment was analyzed in accordance with the California legislation dealing with CNEL noise contours. The ASDS, at the present time, has no associated land use guidelines, and as such, no conclusions regarding compatible land use can be made with ASDS.

(2) Results

The annual and seasonal CNEL and ASDS noise contours are presented in Volume II, Appendix B. The results obtained from analysis of the noise contours are presented here in summary fashion.

Exhibits II-1 and II-2 graphically depict the magnitude of noise impact over time in the language of the CNEL and ASDS descriptor systems, respectively. These exhibits show residential acres (the incompatible land use prescribed by California law), persons, and dwellings within the various contours. (No ASDS

EXHIBIT II-1

San Francisco International Airport

CNEL SUMMARY

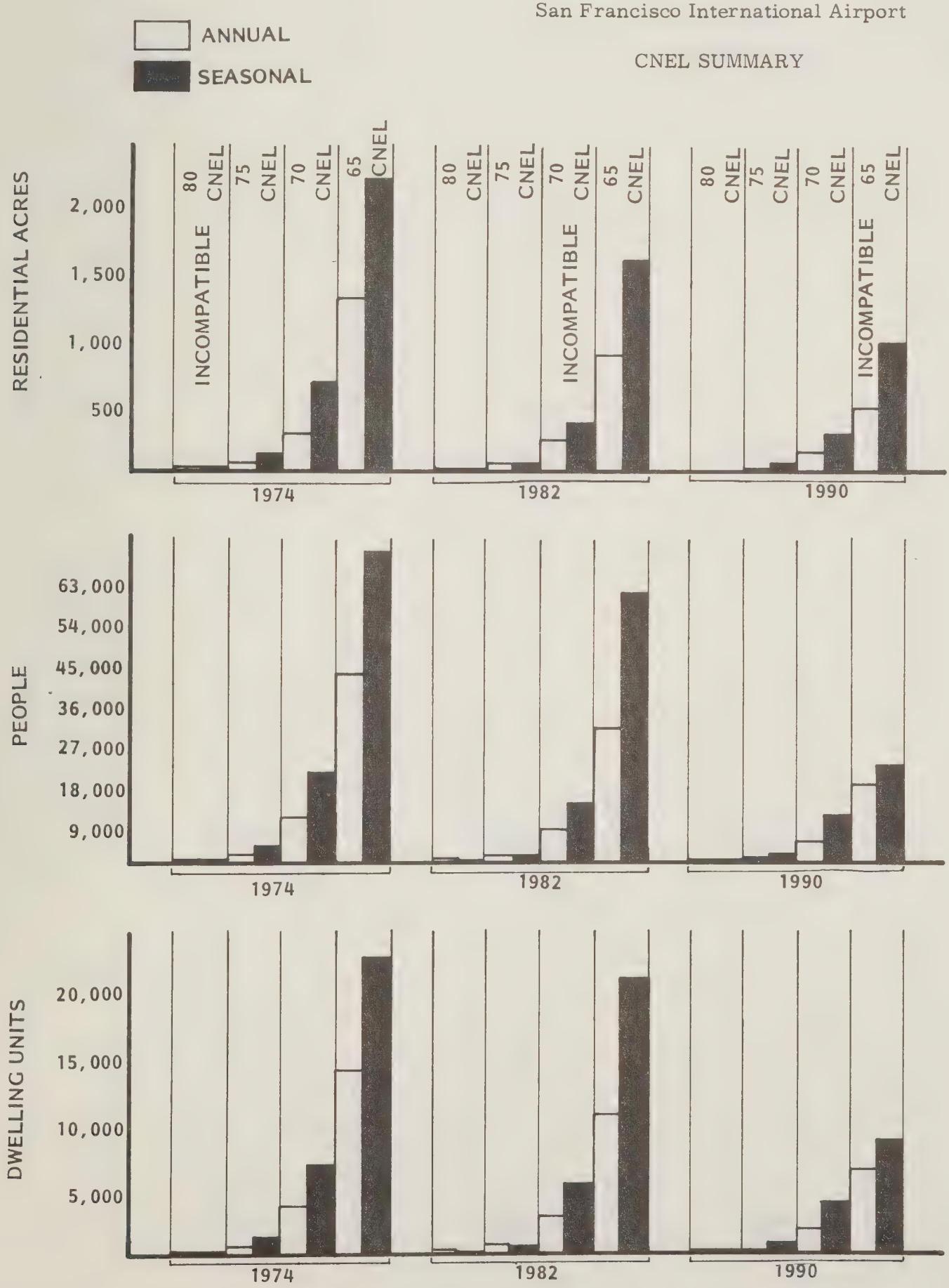
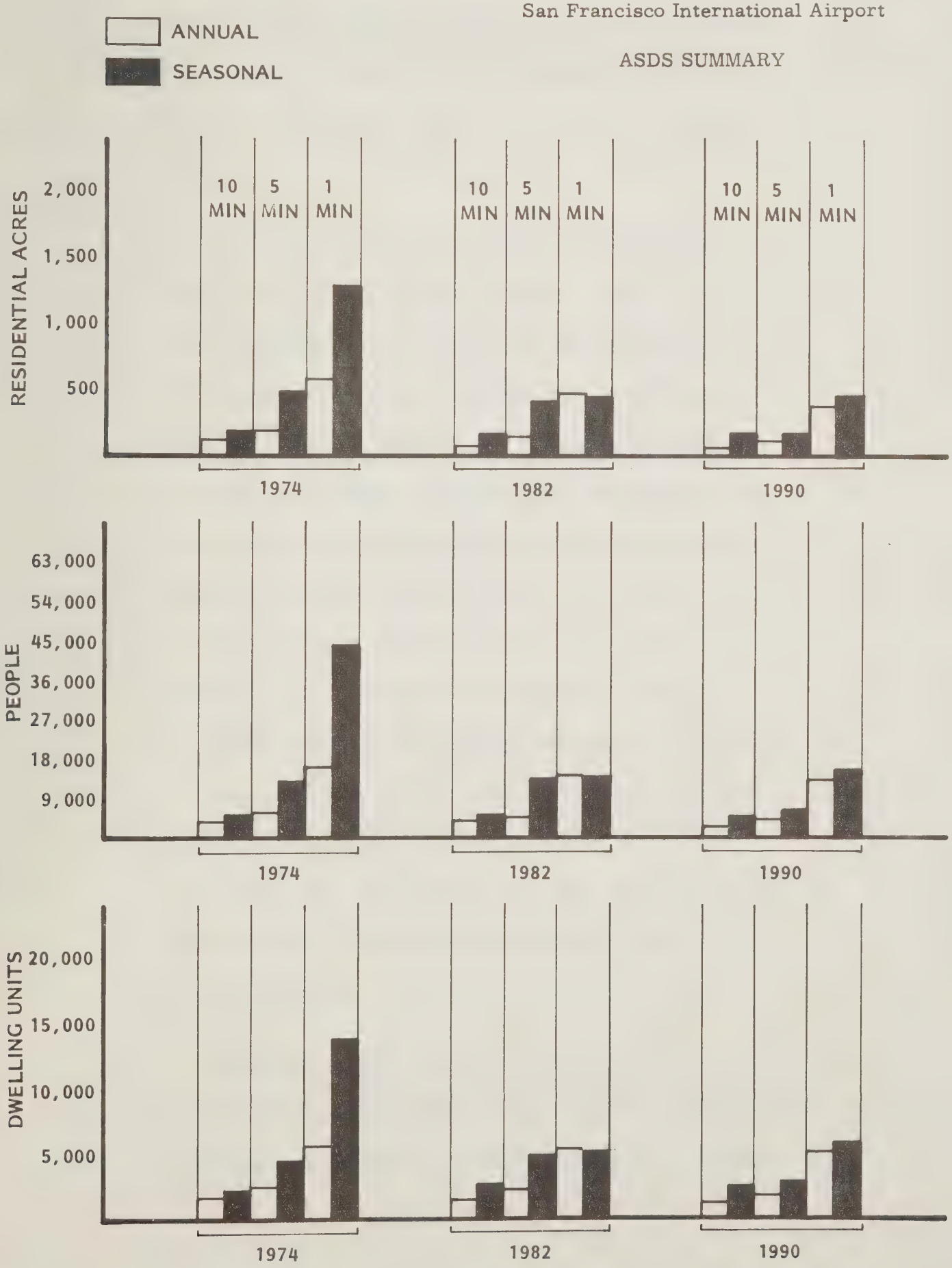


EXHIBIT II-2

San Francisco International Airport

ASDS SUMMARY



criteria presently exist for determination of compatible land use.) Exhibit II-3 presents the noise impact in tabular form and shows the rates of increase or decrease of noise impacted areas.

Examination of these three exhibits indicates that total residential area encompassed by the noise contours (represented by the 65 CNEL contour and the one minute ASDS contour) decreases over time. This decrease is attributed to a higher percentage of quieter aircraft types expected to be in use at SFIA in the future. Further decreases in noise levels can be expected with implementation of the two-segment approach and microwave landing systems. Since the California compatible land use criterion becomes stricter in the future (80 CNEL for 1974, 70 CNEL for 1982 and 65 CNEL for 1990) the number of incompatible residential acres increases over the years. Likewise, the number of people and dwellings within the designated incompatible residential areas increases as do the number of schools. However, this will be the case whether or not the proposed terminal complex expansion is implemented.

In summary, the proposed airport development program will not produce greater levels of noise exposure than would occur without the expansion program. In fact, the magnitude

EXHIBIT II-3

San Francisco International Airport

NOISE IMPACT SUMMARY

	CNEL (Acres)						ASDS (Acres)			
	Incompatible Area		Total Residential Area		Total Area		Total Residential Area		Total Area	
	Annual	Seasonal	Annual	Seasonal	Annual	Seasonal	Annual	Seasonal	Annual	Seasonal
1974	3	3	1,269	2,142	6,338	8,768	532	1,292	4,070	6,057
1982	211	350	815	1,554	4,909	7,076	438	433	3,532	3,501
Percent Change 1974-1982	+7000%	+11600%	-36%	-27%	-23%	-19%	-18%	-66%	-13%	-45%
1990	481	942	481	942	3,325	5,142	399	434	3,286	3,335
Percent Change 1982-1990	+228%	+269%	-41%	-39%	-32%	-27%	-9%	0%	-7%	-5%

of noise impact from aircraft operations is independent of the expansion program, since operations levels and fleet mix characteristics are insensitive to the proposed development program.

3. GROUND ACCESS

The rugged topography that makes San Francisco a picturesque city and guards its residents against any change that might impact adversely upon the quality of life also presents a formidable challenge to the ground transportation system planner. The San Mateo County Peninsula is perhaps the area's prime example of the constricting geographic influence on travel flows.

This ground access analysis was premised upon the same air travel forecasts and development conditions as were the other elements of the environmental assessment. For the ground access analysis, it was important to know not only the levels to which air passenger activity would rise in the future, but also to correlate future levels with the expected year of occurrence of each level. This was a necessity since non-airport travel demands on the roadway system are far more significant in terms of regional consequences. Having established regional travel volumes for these time periods it was possible to assess the impact of airport-related travel with and without the expansion of airport facilities and, at the same time, test the effects in 1990 travel under the assumption that rapid transit (BART) service would be available as an extension from Daly City to San Francisco International Airport.

The ground access analysis required the development of a comprehensive and accurate data base. To develop that data base, several steps were undertaken. First, a careful review and evaluation was conducted of available data related to travel patterns, traffic volumes and the capacity of the existing transportation system. All data obtained from secondary sources were verified and evaluated. These data included geometric configuration of the existing highway system, recent traffic count information, parking inventories, roadway signing/regulatory data; public transportation services (including taxicab service) were interviewed and data were collected on methods of operation, patrons carried, schedules of service, routings and access points, dwell times at curb space, etc.

The inventory included employee-related data on travel characteristics, mode of travel and parking requirements. Finally, ancillary services were inventoried including ground needs for cargo, rental car service, and hotel/motel facilities. The review of these data indicated need for new information which resulted in a data collection effort, as follows:

- Round-the-clock automatic traffic recorder counts at 10 locations
- Manual turning movement/vehicle classification counts for a typical weekday (January 10, 1975)
- Scale drawings of intersections to establish geometric configurations

- Speed and delay runs (at peak and off-peak periods) on major roads in the airport vicinity
- Inventory of posted speed limits, traffic characteristics and control devices
- Special parking studies.

This data collection effort permitted the closing of all major gaps in the data base and assured an inventory of information which would provide a convenient and accurate base for estimating future conditions. The detailed results of this effort including a description of existing access facilities is presented in Appendix C to this report. Exhibit II-4 presents the existing access facilities serving SFIA.

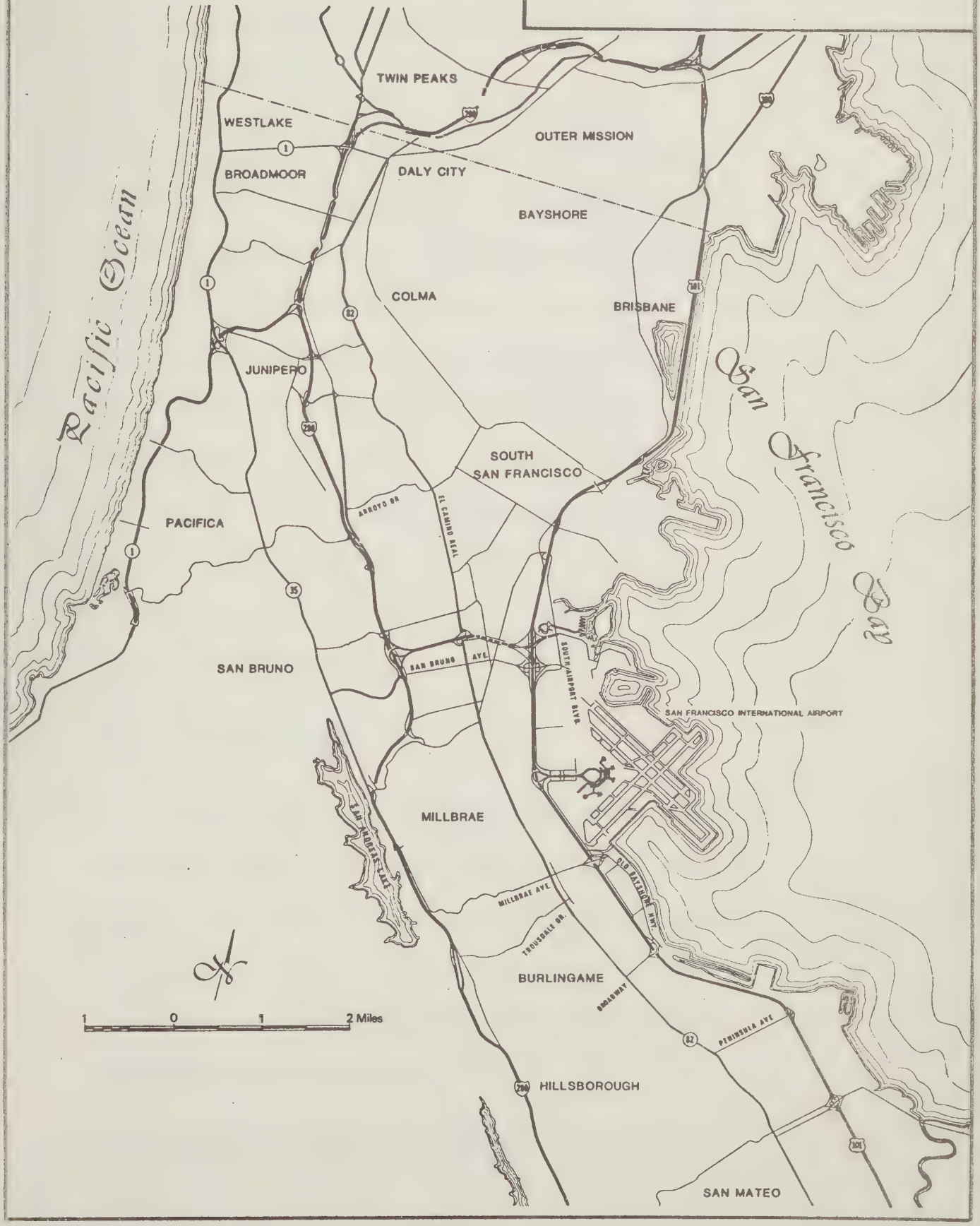
(1) Methodology

To develop reliable estimates of airport-related traffic under future levels of air travel, it is necessary to develop and test a simulation methodology. The basic technique involves establishment of actual conditions, segregating the various elements of that actual market, relating those elements to given future conditions of air travel, related traffic and employee-generated travel, then comparing the "constructed" numbers against actual traffic volumes counted on survey day. After all simulated volumes were assigned, accuracy and verification checks were made by comparing assigned volumes to actual survey day counts. On all roadway links, simulated flows were within 10 percent of actual

EXHIBIT II-4

San Francisco International Airport

ACCESS FACILITIES



(Exhibit II-5) indicating that the simulation process formed a reliable methodology for estimating future traffic, parking and public transit volumes as a function of air travel volumes and other subgroups.

Simulation of travel in and around San Francisco International Airport on the survey day provided an accurate indicator of actual traffic conditions. The examination of airport access facilities, however, requires analysis of travel which is likely to occur on the "design day." The design day (Exhibit II-6 & II-7) is defined as that 24-hour period when the airport experiences the 37th highest daily usage throughout the course of a typical year. For San Francisco International Airport, the month of August registers the highest volume of air passengers and the design day is an average day in that month (about 36 percent greater than survey day).

(2) Impact Assessment

Traffic volume estimates for 1982 and 1990 were used to assess the impacts from a traffic standpoint in and around the airport. The combination of traffic estimates with roadway, intersection, parking and curb frontage capacities [1/] provides the information for performing nine basic impact analyses. These nine can be summarized as follows:

1/ For definition of capacity measurements, see Appendix C

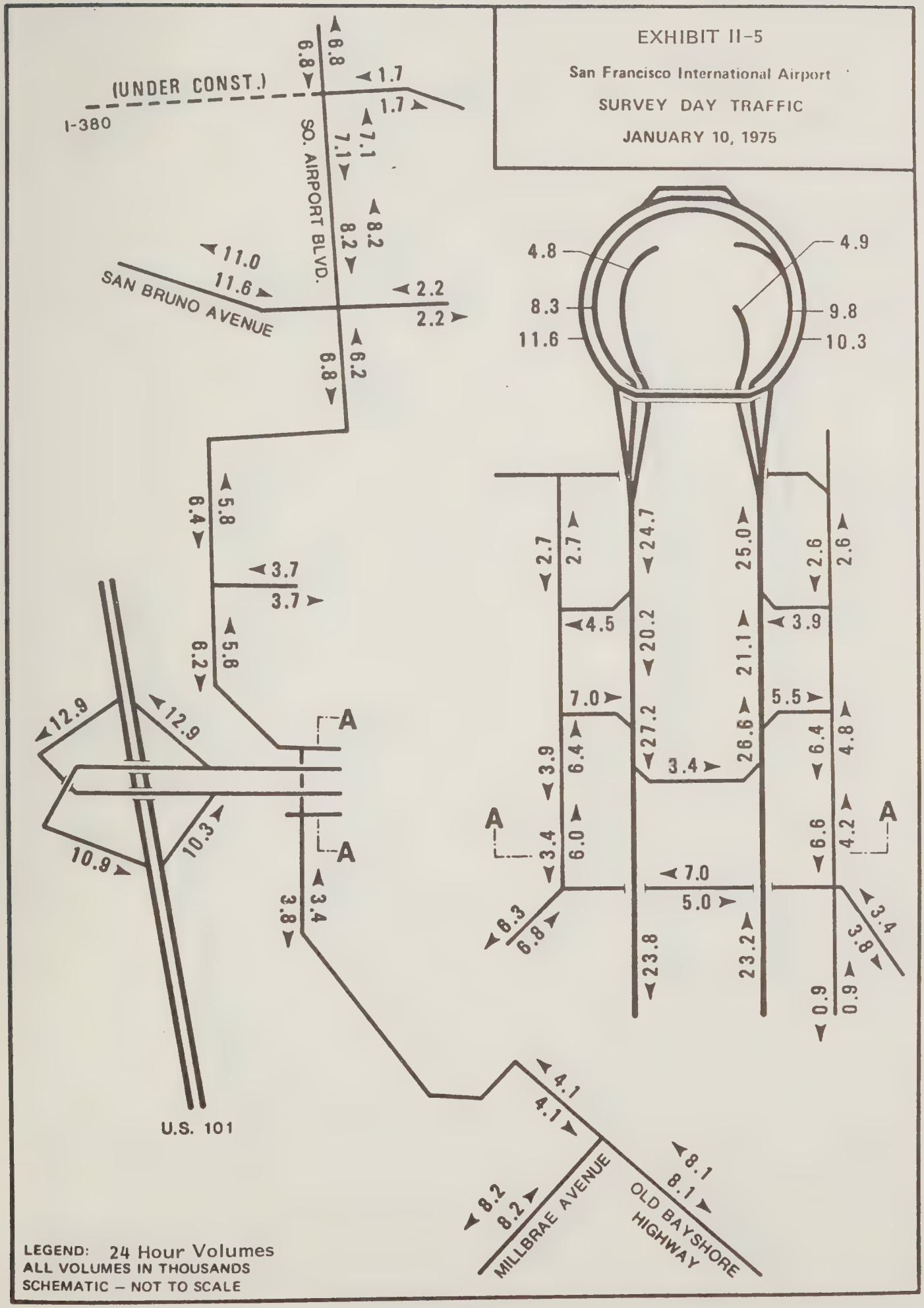


EXHIBIT II-5
San Francisco International Airport
SURVEY DAY TRAFFIC
JANUARY 10, 1975
(UNDER CONST.)
I-380
SO. AIRPORT BLVD.
SAN BRUNO AVENUE
U.S. 101
MILLBRAE AVENUE
OLD BAYSHORE HIGHWAY
A
A
LEGEND: 24 Hour Volumes
ALL VOLUMES IN THOUSANDS
SCHEMATIC – NOT TO SCALE

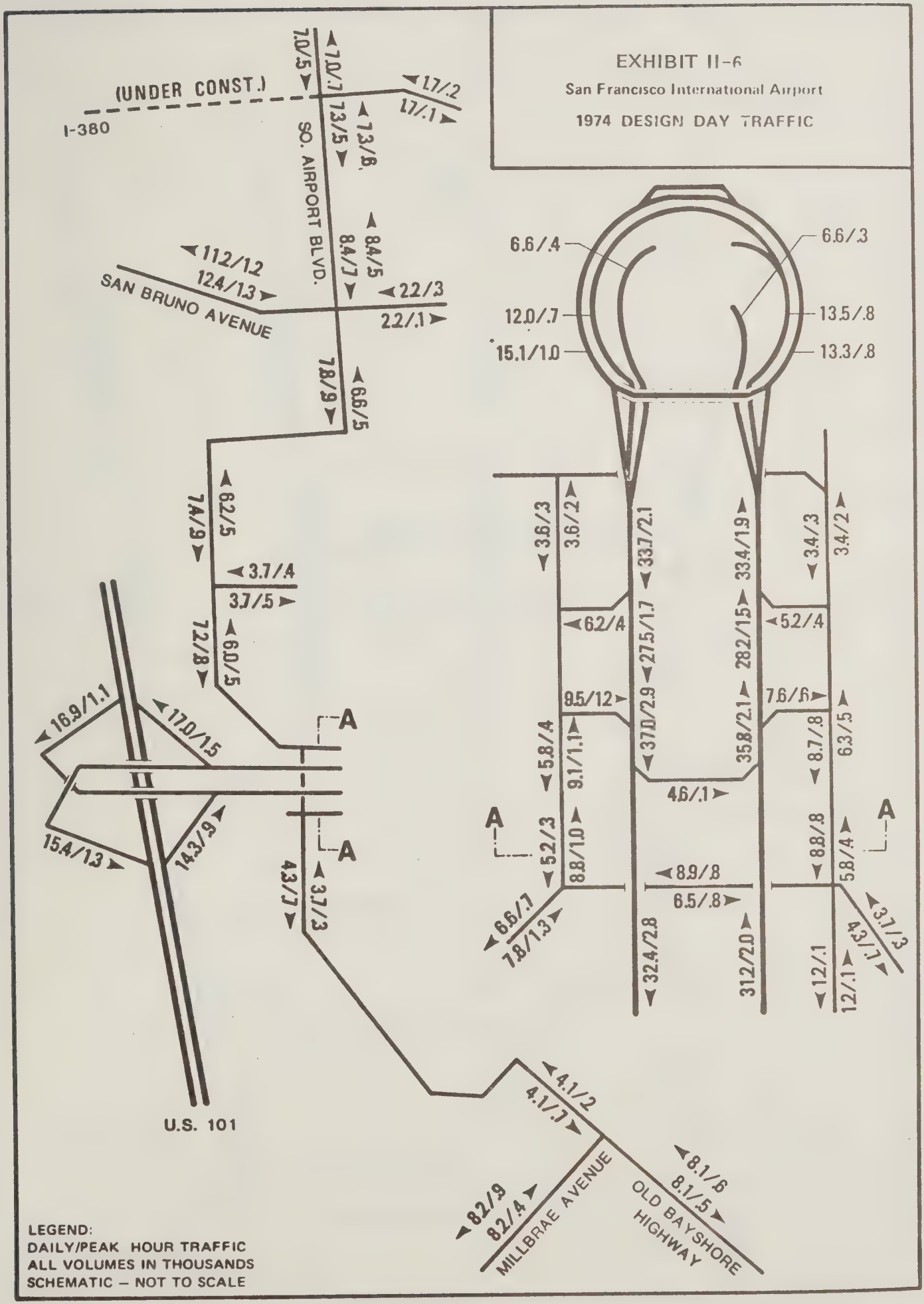


EXHIBIT II-6
San Francisco International Airport
1974 DESIGN DAY TRAFFIC
(UNDER CONST.)
I-380
SO. AIRPORT BLVD.
SAN BRUNO AVENUE
U.S. 101
MILLBRAE AVENUE
OLD BAYSHORE HIGHWAY
7.0/.5
7.0/.7
1.7/.2
1.7/.1
7.3/.5
7.3/.8
8.4/.7
8.4/.5
11.2/12
12.4/13
2.2/.3
2.2/.1
7.8/.9
6.6/.5
7.4/.9
6.2/.5
3.7/.4
3.7/.5
7.2/.8
6.0/.5
16.9/1.1
17.0/1.5
15.4/1.3
14.3/.9
4.3/.7
3.7/.3
6.6/.4
6.6/.3
12.0/.7
13.5/.8
15.1/1.0
13.3/.8
3.6/.3
3.6/.2
33.7/2.1
33.4/1.9
3.4/.3
3.4/.2
6.2/.4
27.5/1.7
28.2/1.5
5.2/.4
9.5/1.2
37.0/2.9
35.8/2.1
7.6/.6
5.8/.4
9.1/1.1
8.7/.8
6.3/.5
4.6/.1
5.2/.3
8.8/1.0
8.8/.8
5.8/.4
8.9/.8
6.5/.8
6.6/.7
7.8/1.3
32.4/2.8
31.2/2.0
12/.1
12/.1
3.1/.3
4.1/.2
4.1/.1
8.1/.6
8.1/.5
8.2/.9
8.2/.4
LEGEND:
DAILY/PEAK HOUR TRAFFIC
ALL VOLUMES IN THOUSANDS
SCHEMATIC – NOT TO SCALE

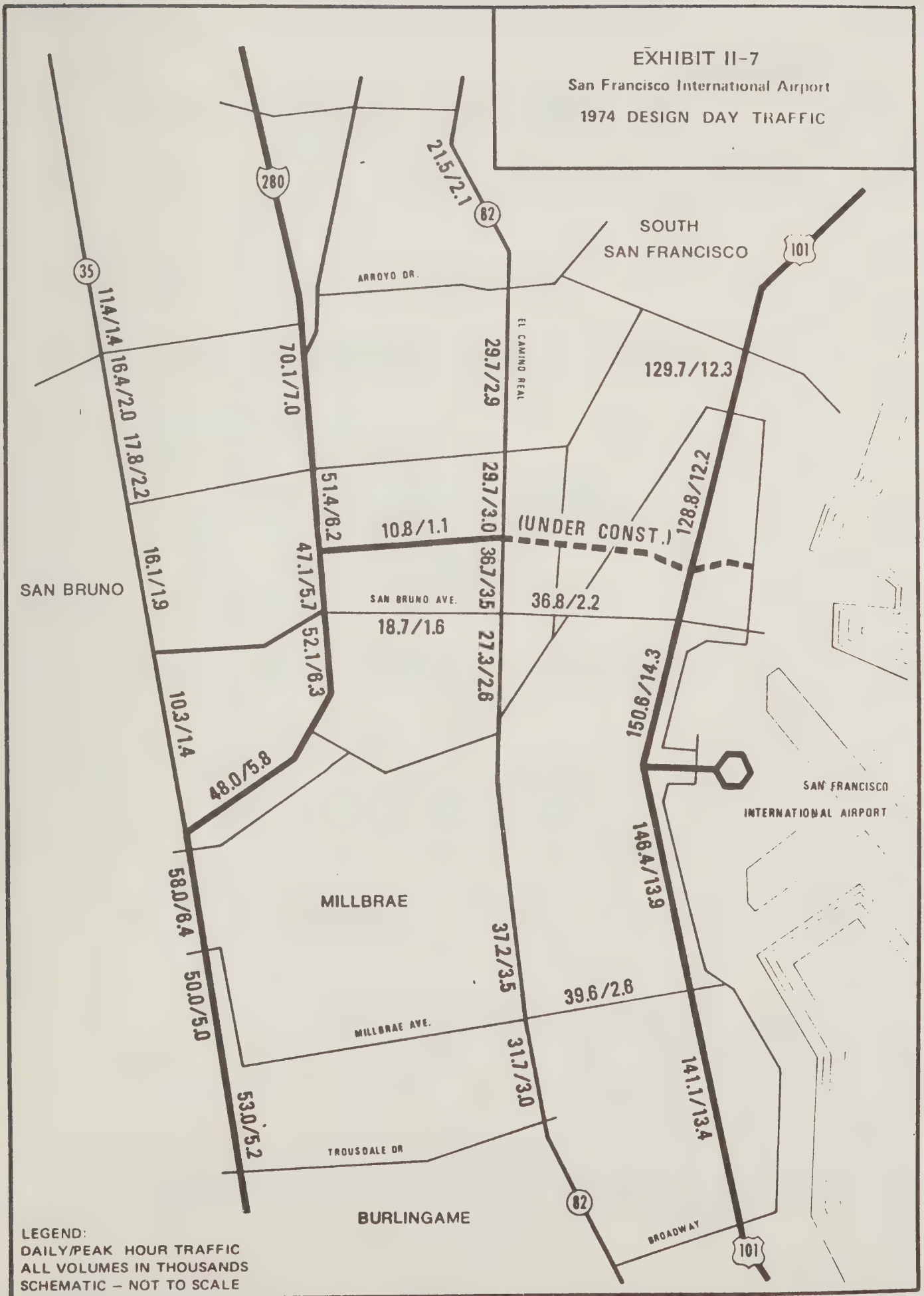


EXHIBIT II-7
San Francisco International Airport
1974 DESIGN DAY TRAFFIC
280
82
101
35
SOUTH
SAN FRANCISCO
ARROYO DR.
EL CAMINO REAL
SAN BRUNO
SAN BRUNO AVE.
MILLBRAE
MILLBRAE AVE.
TROUSDALE DR
BURLINGAME
BROADWAY
SAN FRANCISCO
INTERNATIONAL AIRPORT
(UNDER CONST.)
21.5/2.1
114/1.4
16.4/2.0
17.8/2.2
70.1/7.0
29.7/2.9
129.7/12.3
51.4/6.2
29.7/3.0
10.8/1.1
128.8/12.2
16.1/1.9
47.1/5.7
36.7/3.5
36.8/2.2
18.7/1.6
52.1/6.3
27.3/2.8
150.6/14.3
10.3/1.4
48.0/5.8
58.0/8.4
50.0/5.0
53.0/5.2
37.2/3.5
39.6/2.6
31.7/3.0
141.1/13.4
148.4/13.9
LEGEND:
DAILY/PEAK HOUR TRAFFIC
ALL VOLUMES IN THOUSANDS
SCHEMATIC – NOT TO SCALE

Year	Annual Air Passengers (millions)	Rapid Transit		Terminal Improvements	
		None	Extended	None	As Extended
1974	16.2	X		X	
1982	24.4	X		X	X
1990	31.0	X		X	X

For each of these nine basic cases, six impact items were examined. These include:

- on-airport intersection capacities
- off-airport intersection capacities
- weaving capacity - main entrance road
- public parking sufficiency
- terminal curb frontage needs
- off-airport highway capacities

A further variation in the analysis of these six items involves the need to review their sufficiency at different hours of the day since peak traffic hours for airport traffic do not coincide with peak traffic hours for non-airport traffic. Therefore, where appropriate, the six impact items were examined for three time periods -- 3 to 4 PM, 5 to 6 PM and 7 to 8PM. 1/ This process assures that each impact item will be examined under its respective peak hour conditions.

A review of the findings of these impact assessments is presented for the six areas.

1/ 3 to 4 PM represents employee peak hour.
5 to 6 PM represents normal non-airport highway traffic peak hour.
7 to 8 PM represents air passenger ground traffic peak hour.

- On-airport intersections [2/] - Exhibit II-9 presents a comparison of the operating levels of service of the five on-airport intersections. This analysis has revealed that the on-airport intersections will provide an acceptable level of service under the traffic demands of the 24.4 and 31.0 million air passenger years with the exception of the intersection R3 and R18. Although the provision of a rapid transit extension would result in higher levels of service at two of the five intersections, the overall impact on the traffic demands for the on-airport intersections and roadways is relatively insignificant.

- Off-airport intersections - A summary of the operating levels of service for the five off-airport intersections is shown in Exhibit II-10. Once again, the overall impact analysis has revealed that the off-airport intersections will provide an acceptable level of service during the 24.4 and 31.0 million air passenger years with the exception of the intersection of San Bruno Avenue and South Airport Boulevard. The provision of rapid transit will have no measurable impact on the operating levels of service of the off-airport intersections in 1990. The completion of I-380 and the other highway improvements will result, however, in higher levels of service under 1982 conditions than the existing conditions at a number of the intersections.

- Main access roadway weaving section - Exhibit II-11 presents the overall levels of service for the three critical segments of the main access roadway weaving section. The main access roadway will operate at a lower overall highway speed (5-10 mph) in the 1982 design day due to the increased air passenger traffic. Since Segment 2 controls the overall operation and is sufficiently removed (800 feet) from the airport interchange, no interference with the airport interchange ramps should occur. For the design day in 1990, the main access roadway will operate at capacity with speeds normally below 30 mph and frequently averaging 20 mph or less. The potential of interference with the through traffic on the Bayshore Freeway is high if a traffic accident or other unusual slowdown occurs on the

2/ Exhibit II-8 defines the designation of on-airport intersections.

EXHIBIT II-8

San Francisco International Airport

ON-AIRPORT ROADWAY DESIGNATIONS

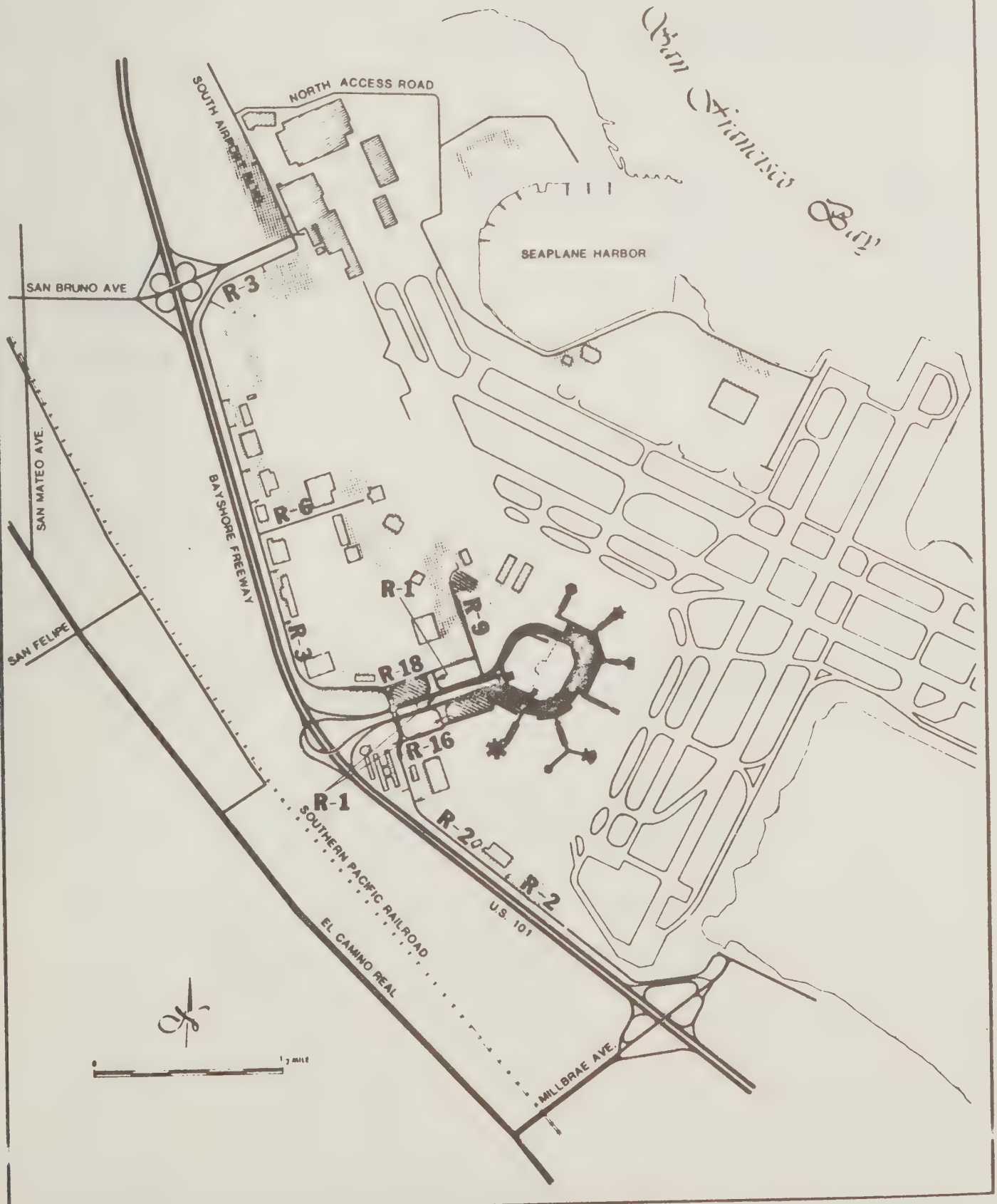


EXHIBIT II-9

San Francisco International Airport

SUMMARY OF ON-AIRPORT INTERSECTION
LEVEL OF SERVICE FOR ALTERNATIVE CONDITIONS

	Level of Service 3/			
Intersection	1974	1982	1990 Without Rapid Transit	1990 With Rapid Transit
R-1 and R-16	A	A	B	B
R-1 and R-18	A	A	C	C
R-2 and R-16	A	A	B	A
R-3 and R-18	C	D	F	F
R-3 and R-6	A	B	E	D

3/ Level of service is a standard highway capacity measure which relates highway characteristics to six (6) "quality of movement" levels (A through F).

Level A - Free flow conditions.
Level B - Free flow with minor restrictive conditions.
Level C - Intermittent loading with more frequent, restrictive conditions, 10 to 30 percent load factor. Design level of service.
Level D - Load factor increases to 30 to 70 percent indicating greater restrictive conditions.
Level E - Maximum capacity. Load factor of 70 to 100 percent.
Level F - Serious congestion. Erratic flow.

EXHIBIT II-10

San Francisco International Airport

SUMMARY OF DESIGN DAY

OFF-AIRPORT INTERSECTION CAPACITY ANALYSIS

Intersection	Level of Service								
	3-4 P.M.			5-6 P.M.			7-8 P.M.		
	1974	1982	1990 1/	1974	1982	1990	1974	1982	1990
San Bruno Avenue & South Airport Blvd.	C	C	F	A	A	B	A	A	A
North Access Road & South Airport Blvd.	A	B	C	A	A	A	A	A	A
Millbrae Avenue & Old Bayshore Highway	A	A	A	A	A	A	A	A	A
El Camino Real & San Bruno Avenue	C	A	B	E	B	D	A	A	B
El Camino Real & Millbrae Avenue	B	C	B	E	B	D	A	A	B

1/ Rapid transit effect insufficient to change level of service.

EXHIBIT II-11

San Francisco International Airport

SUMMARY OF WEAVING SECTION ANALYSIS
SOUTH RAMPS - MAIN ROADWAY
DESIGN DAY - PEAK HOUR

Conditions	Overall Roadway Level of Service		
	Segment 1	Segment 2	Segment 3
1974	C	C	A
1982	C	D	C
1990 Without Rapid Transit	E	D	B
1990 With Rapid Transit	D	D	B

Segment 1 - Begins at the confluence of north and south access roads from U.S. 101 and ends just beyond the first exit to the frontage road but before the first entrance from the frontage road.

Segment 2 - From the end of Segment 1 to the divergence of lanes to enplaning and deplaning roadways.

Segment 3 - From the end of Segment 2 to the divergence of enplaning roadway and garage entrance roadway.

main access roadway. The provision of rapid transit would result in an improvement in the main access roadway's overall operating speeds (5-10 mph) over the 1990 conditions without rapid transit. The operating characteristics of the roadway with rapid transit will be similar to those encountered in 1982.

Public parking facilities - The projected peak parking accumulation for 1982 and 1990 is 6,779 and 8,403 spaces, respectively. As such, an evaluation of the future public parking supply/demand relationships reveals a projected deficiency of 600 spaces in 1982 and 2,300 spaces in 1990 (under the alternative of no improvements to the public parking supply). The provision of 10,134 spaces in 1990 (7,300 garage spaces) would represent 83 percent occupancy during the peak day parking accumulation of the design week. Exhibit II-12 presents the results of the analysis.

Curb frontage - A practical capacity of 70 percent has been determined as the desired level of usage for curb frontage. Without the provision of the north terminal curb space, the enplaning roadway would continue to function below capacity in 1982 and 1990. The deplaning roadway, however, would exceed capacity in both 1982 (100 percent usage) and 1990 128 percent usage). The allowance for the north terminal curb frontage and the curb frontage adjacent to the two plaza areas between the three terminals (with expansion conditions), would lower the usage on the deplaning roadway to 56 percent in 1982 and 75 percent in 1990. The provision of rapid transit would lower the required usage on the deplaning roadway to 41 percent and 71 percent, respectively. Exhibit II-13 presents the results of the analysis.

Off-airport highway utilization - Exhibit II-14 presents the results of the off-airport highway utilization analysis of the Bayshore Freeway and its interchanges with the airport, San Bruno Avenue, and Millbrae Avenue. Due to the completion of I-380 and the reconstruction and expansion of the Bayshore Freeway north to the I-380 interchange, the analysis has revealed that the main line section of the Bayshore Freeway (north of the airport interchange), its interchanges with San

EXHIBIT II-12

San Francisco International Airport

ANALYSIS OF PUBLIC PARKING FACILITIES

	Peak Design Day Accumulation	Spaces Available	Percent Filled
1974	4,986	6,779	73.6%
1982			
- Without Improvement	6,722	6,779	99.2%
- With Improvement	6,722	10,134	66.3%
1990			
- Without Improvement	8,403	6,779	124.0%
- With Improvement	8,403	10,134	82.9%

EXHIBIT II-13

San Francisco International Airport

SUMMARY OF CURB FRONTAGE ANALYSIS

	Available Ft. Min.	Required Ft. Min.	Percent Used
1974 Design Day, Peak Hour			
Central Terminal			
Deplaning Roadway	74,400	61,534	82.7%
Enplaning Roadway	68,160	32,292	47.4%
South Terminal			
Deplaning Roadway	74,640	41,081	55.0%
Enplaning Roadway	66,240	21,538	32.5%
1982 Design Day, Peak Hour (Without Expansion)			
Two Terminals			
Deplaning Roadway	149,040	149,575	100.4%
Enplaning Roadway	134,400	75,695	56.3%
1982 Design Day, Peak Hour (With Expansion)			
Three Terminals			
Deplaning Roadway	271,800	160,025	58.9%
Enplaning Roadway	249,600	85,870	34.4%
1990 Design Day, Peak Hour (Without Expansion)			
Two Terminals			
Deplaning Roadway	149,040	190,840	128.0%
Enplaning Roadway	134,400	96,230	71.6%
1990 Design Day, Peak Hour (With Expansion)			
Three Terminals			
Deplaning Roadway	271,800	204,510	75.2%
Enplaning Roadway	249,600	109,210	43.8%
1990 Design Day, Peak Hour (With Expansion) and Rapid Transit Extension to San Francisco International Airport			
Three Terminals			
Deplaning Roadway	271,800	192,585	70.8%
Enplaning Roadway	249,600	102,100	40.9%

EXHIBIT II-14

San Francisco International Airport

SUMMARY OF DESIGN DAY

OFF-AIRPORT HIGHWAY UTILIZATION

Facility/Location	Level Of Service: 3-4 P.M. 1974	3-4 P.M. 1982	3-4 P.M. 1990 Without Rapid Transit	3-4 P.M. 1990 With Rapid Transit	5-6 P.M. 1974	5-6 P.M. 1982	5-6 P.M. 1990 Without Rapid Transit	5-6 P.M. 1990 With Rapid Transit	7-8 P.M. 1974	7-8 P.M. 1982	7-8 P.M. 1990 Without Rapid Transit	7-8 P.M. 1990 With Rapid Transit
Freeway												
Bayshore Freeway												
So. of Airport Ramps (Northbound)	C	C	D	-	D	D	E	-	B	B	C	-
So. of Airport Ramps (Southbound)	C	D	D	-	D	E	F	-	B	B	C	-
No. of Airport Ramps (Northbound)	C	B	C	C	D	C	D	C	B	B	B	B
No. of Airport Ramps (Southbound)	C	C	C	C	E	C	D	C	B	B	B	B
Interchanges												
Bayshore Freeway												
Airport - SB-FR/Airport	C	F	F	-	B	C	F	-	B	C	F	-
SB-TO/Airport	B	A	B	B	B	A	B	B	B	B	C	C
NB-FR/Airport	C	B	D	C	B	A	B	B	C	B	D	C
NB-TO/Airport	B	C	F	-	B	C	F	-	A	C	E	-
San Bruno Avenue - SB-FR/Airport	C	B	B	-	B	A	A	-	A	A	A	-
SB-TO/Airport	A	A	A	-	A	A	A	-	A	A	A	-
NB-FR/Airport	A	A	A	-	A	A	A	-	A	A	A	-
NB-TO/Airport	A	A	A	-	A	A	A	-	A	A	A	-
Millbrae Avenue - SB-FR/Airport	B	D	D	-	A	B	B	-	A	A	A	-
SB-TO/Airport	A	B	B	-	B	C	C	-	A	A	A	-
NB-FR/Airport	B	C	C	-	B	B	C	-	A	A	A	-
NB-TO/Airport	A	A	A	-	A	A	B	-	A	A	A	-

Bruno Avenue and Millbrae Avenue, and the airport ramps to and from the airport from the north will provide acceptable levels of service in both 1982 and 1990. The airport ramps to and from the airport from the south will operate at or over capacity during the critical hours of the analysis. The main line of the Bayshore Freeway (south of the airport interchange) will operate at level of service E or better during the 1982 analysis hours and over capacity during the normal highway peak hour in 1990. Once again, the provision of rapid transit results in a slight improvement to the overall off-airport highway utilization.

In summary then, the proposed development at SFIA brings with it significant benefits to the airport roadway network and as discussed below, these benefits translate also into positive influences on air quality.

4. AIR POLLUTION

As part of the RASS, the Bay Area Air Pollution Control District performed a study in 1971 (Aviation Effect On Air Quality) to predict air quality conditions at several Bay Area airports, including SFIA. This study indicated that in 1972, aircraft contributed approximately 1.5 percent of all air contaminant emissions in the Bay region, and that by 1985, this contribution would increase to approximately 6.0 percent because of increased air travel together with decreased emissions from automotive sources.

The proposed terminal expansion at SFIA in and of itself will not cause increased air pollution in the Bay region or in the environs of SFIA. Aircraft and ground access traffic, which are the major contributors of air pollution at the airport, will be the same in future years whether or not the proposed terminal

complex expansion is implemented. However, the operational efficiency of the airport is highly dependent upon the degree to which the facility is developed to accommodate the inevitable increases in traffic. The resulting efficiency, expressed in terms of both aircraft and motor vehicle movements and delays, will in turn affect air quality.

With the above in mind, the San Francisco Airports Commission, undertook this study in December, 1974 to provide current data on the effect of SFIA operations on air quality and to determine specifically the impact, if any, of the proposed terminal expansion on air quality. The study included air quality monitoring in the vicinity of SFIA, an emission inventory and dispersion modeling. The results of this analysis, together with detailed information regarding airport sources of air contaminants, are presented in detail in Volume II, Appendix D of this EIAR, and are highlighted below:

(1) Approach

The air quality evaluation was accomplished by two basic approaches. These included:

- Emission inventory of all significant airport-related and non-airport (near vicinity) activities which generate air pollution
- Atmospheric dispersion modeling, which gives consideration to the spatial distribution of emissions developed in the inventory, and the effects of meteorological conditions on resultant pollutant concentrations.

The results of the emission inventory were used to assess the contribution of airport-related activities to the total emission load on the region. The results of the dispersion modeling provided an indication of compliance with State of California and National Ambient Air Quality Standards (NAAQS). The emission inventory and dispersion modeling techniques are described in detail in Volume II, Appendix D, Section 4, entitled Evaluation Methodology.

The pollutants considered in the air quality evaluation included the following:

- Carbon monoxide
- Total hydrocarbons
- Oxides of nitrogen
- Sulphur dioxide
- Particulate matter
- Oxidant

Emission factors for the various airport and non-airport sources were based on EPA data as reported in AP-42, Compilation of Emission Factors. Data requirements for the modeling effort included detailed descriptions of aircraft and ground support vehicle activity, airport stationary sources, and mobile source activity for the airport and its environs.

Air quality impact due to SFIA-related operations was evaluated for existing conditions (1974), as well as for forecast 1982 and 1990 conditions. In the dispersion modeling analysis, the effect of seasonal and diurnal variations of traffic levels and meteorology was considered. Thus, the dispersion modeling results are presented in terms of "typical" conditions (average daily traffic and most probable meteorology) and "worst-case" conditions (design delay traffic and most adverse meteorology). Both the emission inventory and dispersion modeling results provided a relative measure of the effects on air quality of the six evaluation scenarios.

The analysis also included the assessment of the variable "vehicle miles traveled" (VMT) for each of the six scenarios. The estimated VMT for each scenario is an indication of the average round trip distance which ground access traffic would accrue (on and off airport) traveling to and from the airport. The importance of VMT in the analysis is to demonstrate compliance with the State of California "Transportation Control Strategies" and "Air Quality Implementation Plans" for critical regions. These strategies call for minimization of VMT for these critical regions.

(2) Results

The detailed results of the air quality analysis are presented in Volume II, Appendix D in terms of airport-related and vicinity emissions, airport vicinity pollutant concentrations, and airport-related VMT within the region. Included in Appendix D are isopleths (contour lines of equal air pollutant concentrations) for the principal air contaminants of interest. The results of the air quality evaluation are presented here in summary fashion.

1. Emission Inventory

Exhibits II-15 and II-16 summarize the emission inventory for the various airport and non-airport sources and for the six evaluation secenarios. Exhibit II-15 presents the emission inventory results for each of the five principal pollutants; carbon monoxide, total hydrocarbons, oxides of nitrogen, sulfur dioxide and particulate matter, while Exhibit II-16 presents the grand total emissions for the five pollutants. Examination of Exhibit II-16 indicates a significant reduction in total airport related emissions, from approximately 105 tons/day in 1974 to approximately 45 tons/day in 1990. These results are principally due to the programmed reductions in motor vehicle emissions. This reduction in total airport-related emissions has a net positive effect on improved local air quality and reduced total air pollution emitted in the Bay region.

The results of the emission inventory indicate slightly fewer total emissions under the proposed airport development option than the no development option. This result is attributable to reduced motor vehicle idle time at the terminal curbfront with the addition of the North Terminal. The alternative which assumes a BART link to the airport results in only slightly fewer total emissions than the other options. Only slight reduction in total emissions with BART is indicated since the concept has the effect of replacing in part, the current form of mass transit (airporter bus), and does not effectively replace the use of private automobiles for airport access.

EXHIBIT II-15
San Francisco International Airport
EMISSION INVENTORY
Page 1 of 2

SOURCE	POLLUTANT EMISSIONS (TONS/DAY)																	
	CARBON MONOXIDE						TOTAL HYDROCARBONS						OXIDES OF NITROGEN					
	1974	1982 No Dev.	1982 Proj.	1990 No Dev.	1990 W/O BART	1990 W BART	1974	1982 No. Dev.	1982 Proj.	1990 No Dev.	1990 W/O BART	1990 W BART	1974	1982 No Dev.	1982 Proj.	1990 No Dev.	1990 W/O BART	1990 W BART
AIRPORT RELATED																		
On-Report																		
Aircraft	10.0	10.9	10.9	10.7	10.7	10.7	5.6	4.9	4.9	4.1	4.1	4.1	6.3	10.5	10.5	11.7	11.7	11.7
Motor Vehicles	11.2	3.6	2.7	2.9	2.5	2.1	1.1	0.4	0.3	0.26	0.22	0.18	1.0	0.4	0.35	0.27	0.26	0.24
Service Vehicles	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Stationary Sources	0.20	0.20	0.21	0.20	0.21	0.21	0.10	0.10	0.10	0.10	0.10	0.10	0.42	0.42	0.46	0.42	0.46	0.46
Total On-Airport	21.4	14.7	13.8	13.8	13.4	13.0	6.8	5.4	5.3	4.5	4.4	4.4	7.7	11.3	11.3	12.4	12.4	12.4
Off-Airport 3/	53.0	14.3	14.3	7.3	7.3	6.9	5.7	1.8	1.8	1.1	1.1	1.0	8.5	4.1	4.1	2.9	2.9	2.7
Total Airport Related 1/	74.4	29.0	28.1	21.1	20.7	19.9	12.5	7.2	7.1	5.6	5.5	5.4	16.2	15.4	15.4	15.3	15.3	15.1
AIRPORT VICINITY 2/																		
Motor Vehicles Not Accessing Airport, But in Vicinity	32.7	8.3	8.3	6.5	6.5	6.1	3.6	0.8	0.8	0.5	0.5	0.45	5.1	1.5	1.5	1.0	1.0	0.9

EXHIBIT II-15
San Francisco International Airport
EMISSION INVENTORY
Page 2 of 2

POLLUTANT EMISSIONS (TONS/DAY)												
	SULFUR DIOXIDE						PARTICULATES					
SOURCE	1974	1982 No Dev.	1982 Proj.	1990 No Dev.	1990 W/O BART	1990 W BART	1974	1982 No Dev.	1982 Proj.	1990 No Dev.	1990 W/O BART	1990 W BART
AIRPORT RELATED												
On-Report												
Aircraft	0.11	0.13	0.13	0.13	0.13	0.13	0.38	0.31	0.31	0.28	0.28	0.28
Motor Vehicles	0.41	0.12	0.07	0.19	0.14	0.10	0.13	0.19	0.16	0.29	0.25	0.21
Service Vehicles	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg	Neg.	Neg.	Neg.
Stationary Sources	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	0.10	0.10	0.10	0.10	0.10	0.10
Total On-Airport	0.52	0.25	0.20	0.32	0.27	0.23	0.61	0.60	0.57	0.67	0.63	0.59
Off-Airport 3/												
Access Vehicles	0.24	0.41	0.41	0.59	0.59	0.56	0.98	1.7	1.7	2.5	2.5	2.3
Total Airport Related 1/	0.76	0.66	0.61	0.91	0.86	0.79	1.5	2.3	2.3	3.2	3.1	2.9
AIRPORT VICINITY 2/												
Motor Vehicles Not Accessing Airport, But In Vicinity	0.15	0.14	0.14	0.16	0.16	0.15	0.9	0.6	0.6	0.7	0.7	0.6

Note: Neg. = Negligible or approximately less than 0.001 tons/day.

1/ Airport related emissions are those induced by airport related activities, and represent the total emission load on the Bay region attributable to SFIA.

2/ Airport vicinity emissions affect air quality in the vicinity of the airport, but are not attributable to SFIA activities.

3/ Off-Airport emissions generated by access vehicles are attributable to SFIA, but do not totally affect air quality in the vicinity of the airport since part of the activities occur many miles from the airport.

EXHIBIT II-16

San Francisco International Airport
SUMMARY OF TOTAL EMISSIONS

Source	TOTAL EMISSIONS 2/ (TONS/DAY)					
	1974	1982 No Dev.	1982 Proj.	1990 No Dev.	1990 Proj. W/O BART	1990 Proj. W/BART
Airport Related						
On-Airport						
Aircraft	22.4	26.8	26.8	26.9	26.9	26.9
Motor Vehicles	13.8	4.7	3.6	3.9	3.4	2.8
Service Vehicles	0.03	0.03	0.03	0.03	0.03	0.03
Stationary Sources	0.82	0.82	0.87	0.82	0.87	0.87
Total On-Airport	37.1	32.4	31.3	31.7	31.2	30.6
Off-Airport						
Access Vehicles	68.4	22.3	22.3	14.4	14.4	13.5
Total Airport Related	105.5	54.7	53.6	46.1	45.6	44.1
Airport Vicinity						
Motor Vehicles Not Accessing Airport, but in Vicinity	42.5	11.3	11.3	8.9	8.9	8.2
Estimated Total 1/ Airport Vicinity	93.3	48.2	47.1	43.5	43.0	41.5

1/ Total airport vicinity emission is estimated to be equal to the sum of total on-airport emissions, airport vicinity emissions and 20 percent of the total off-airport (access vehicle) emissions.

2/ Total emissions are equal to the sum of carbon monoxide, hydrocarbon, oxides of nitrogen, sulphur dioxide and particulate emissions.

2. Predicted Air Quality Concentrations

The results of the predicted air quality concentrations are summarized in the form of isopleths and tables (refer to Exhibits D-42 through D-65 and Exhibits D-66 through D-71 in Volume II, Appendix D). Examination of the isopleths and tabular exhibits indicates a wide variance of pollutant concentrations depending upon location. Highest pollutant values occur within the airport boundary, primarily near passenger loading and unloading zones (curbfront), adjacent active runways, near airfield apron areas, and near access roadways. The location of overall highest pollutant concentrations is at curbside of the lower level terminal areas.

Further examination of the exhibits indicate a definite trend toward improved air quality in future years. For example, the resultant concentrations of the various pollutants are approximately one-half as great in 1982 as they are today. By the year 1990, pollutant concentrations would be further reduced by approximately one-half those which would exist in 1982.

A comparison of the predicted pollutant concentrations to applicable ambient air quality standards indicates some potential violation of standards. Under conditions which would exist more than 50 percent of the time (for example, "typical" conditions), the results indicate the following:

- There would be no violation of either the one hour or eight hour carbon monoxide standards.

- There would be no violation of sulphur dioxide standards.

- The one hour nitrogen dioxide standard (0.25 ppm) would be violated under all scenarios, during 1974, 1982 and 1990, principally at on-airport locations such as at terminal curbfronts and adjacent to active runways.

- The federal standard for non-methane hydrocarbons (0.24 ppm, three hour average, 6 to 9 a.m.) would apparently be violated under all scenarios, during 1974, 1982 and 1990. These violations would occur primarily on airport.

- The California 24 hour standard for particulate matter (100 micrograms/meter^3) would not be violated in 1974. However, there would be some on-airport violations in 1982 and 1990 under all acenarios. (Since there is no projected improvement in particulate emission rates for automobiles, levels increase with time as traffic increases.)

Under most adverse conditions ("worst-case"), the results indicate the following:

- There would be no violations of sulphur dioxide standards.

- For today's conditions (1974), there would be a potential violation of the one hour carbon monoxide standard (35 ppm) at the upper South Terminal curbfront (US) 1/, and at the lower level terminal curbfront (LL). In 1982, there would be a violation at LL under the no development alternative. No other violations of this standard would occur.

- For 1974, there would be violations of the eight hour carbon monoxide standard (9 ppm) at locations US, UC, LL, AP and 1R, all on-airport locations. Under the no development alternative violations would occur in 1982 and 1990 at locations US and LL. Under the proposed development a violation at LL would occur in 1982, but no violations would occur by 1990.

1/ Locations for determining air quality are defined as follows: south terminal curbfront (US); lower level terminal curbfront (LL); central terminal curbfront (UC); apron (AP); and south end of runway 1R (1R).

- Violations of the nitrogen dioxide standard would occur under all scenarios and all years. These violations would occur principally on-airport, however, a few violations would occur off-airport such as at Coyote Point (CP), San Mateo (SM), and Foster City (FC).

- Violations of the non-methane hydrocarbon and oxidant standard would apparently occur under all scenarios and all years. These violations would occur principally on-airport, however, a few violations would occur off-airport.

- Violations of the particulate matter standards would occur under all scenarios and all years. Levels would increase with time with violations occurring both on and off the airport.

It should be noted that the probability of occurence of the most adverse conditions is very small, and is of the order of three days per year. However, since the criteria of the applicable ambient air quality standards are levels not to be exceeded but once per year, the conclusions noted above are valid ones.

Further review of the results indicates that the air quality impact on the surrounding communities is small. Where violations of ambient air quality standards occur, these violations are primarily limited to locations on the airport. Furthermore, under "typical" conditions most pollutant concentrations are well within applicable standards.

In comparing the various evaluation scenarios, the proposed airport development option results in improved air quality in comparison to existing conditions, and to those conditions which would exist if no further development takes place. The air quality conditions, are improved under the proposed development primarily because of improved vehicle traffic flow and reduced idle time in the vicinity of the terminal curbfronts. This is evident when comparing the results of the predicted concentrations for locations adjacent to the terminal curbfronts (US, UC, UN, and LL) for the proposed development versus no further development. With the addition of the North Terminal, ground vehicle traffic will be less concentrated and will flow more smoothly at passenger loading and unloading zones due to the increase in curb frontage.

3. Vehicle Miles of Travel (VMT)

Exhibit II-17 summarizes the airport related VMT generated within the Bay region for the six evaluation scenarios. As indicated, the airport-related VMT is directly related to total air passengers. From 1974 to 1990 air passengers at SFIA will increase twofold.

The different airport configurations basically do not affect the resultant VMT, since VMT is a function of passenger demand and not airport facilities. The introduction of a BART link to SFIA would effectively reduce VMT by only approximately 5 percent.

The "Transportation Control Strategy'" for the Bay region calls for significant reductions of VMT within the region. The forecast increased passenger demand at SFIA will result in increases in airport-related VMT, and therefore is not consistent with this strategy. However, the proposed airport development would not aggravate this problem, since the increases in VMT would result with or without the airport expansion.

The RASS and subsequent regional studies of the Bay region transportation system have recommended ultimate allocation of air passenger demand at SFIA of 31 MAP in 1990. This decision has been made with consideration of the overall impacts on the region, including transportation facilities, socioeconomic and environmental. The net effect of the regional decision is an unavoidable increase of SFIA related VMT. As noted, this resultant increase is independent of the proposed airport development.

* * * * *

In summary, the following conclusions can be drawn in regard to the probable impact of the proposed terminal expansion on air quality.

- The proposed airport development program will not aggravate the air quality conditions at the airport or in adjacent communities. In fact, if further airport development does not take place a deterioration of local air quality will result due to increased vehicle congestion at the existing terminal curbfronts and

Year	Airport Configuration	Total 1/ Passengers (MAP)	Daily Airport-Related VMT 2/		
			Off-Airport	On-Airport	Total
1974	Existing	16.2	1,807,000	162,500	1,969,500
1982	No Further Development	24.4	3,507,000	206,300	3,263,300
	Proposed Development	24.4	3,507,000	206,300	3,263,300
1990	No Further Development	31.0	4,420,000	280,200	4,700,200
	Proposed Development-Without BART	31.0	4,420,000	280,200	4,700,200
	Proposed Development-With BART	31.0	4,190,000	258,600	4,448,600

1/ MAP = Million Air Passengers, on and off

2/ VMT = Vehicles Miles of Travel

Source: BASAR Distribution and Landrum and Brown estimates

EXHIBIT II-17
San Francisco International Airport
SUMMARY OF AIRPORT RELATED VMT

extended aircraft idle time at apron gate areas. The addition of the North Terminal will add significantly to usable motor vehicle curb frontage, thus permitting more efficient vehicle flow, less congestion and reduced idle times. Additional aircraft gates, particularly those for wide-bodied aircraft, will permit more efficient operation at apron and taxi areas, which will in turn result in less air pollution.

- SFIA is a significant indirect source of air pollutants in the local area. However, the evaluation indicates that the highest concentrations of pollutants are confined to the airport property in close proximity to the automobile and aircraft centers, and that the air quality within the communities surrounding SFIA is generally with acceptable limits.

- There currently are violations of State of California and National Ambient Air Quality Standards at the airport. These include violations of the one hour and eight hour carbon monoxide standards, the one hour standard for nitrogen dioxide, the three hour standard for non-methane hydrocarbons, and the one hour oxidant standard. These violations principally occur during most adverse conditions, for example, during peak traffic and worst case meteorological conditions. The probability of occurrence of these violations is of the order of three days per year. The locations where standards are being violated include terminal curbfront areas near passenger loading and unloading zones, apron areas, and adjacent active runways.

- The results of the evaluation show a clear trend toward overall improvement of local airport area air quality conditions in the 1982 and 1990 time periods which were analyzed. For example, total airport-related emissions will be reduced from approximately 105 tons per day in 1974 to approximately 45 tons per day in 1990. (The improvements are principally due to reduced emissions from motor vehicles.) As a result both on-airport and local air pollution concentrations will be reduced. If the proposed airport development takes place, no

violations of the one hour or eight hour carbon monoxide standards will occur by 1990 even under most adverse conditions. On the other hand, if no further development takes place, violations of the eight hour carbon monoxide standard will occur. By the year 1990 there will still be potential violations of nitrogen dioxide, non-methane hydrocarbon, oxidant and particulate standards for both the proposed development or no development options.

5. WATER POLLUTION

By the mere fact of its presence, San Francisco International Airport generates a substantial requirement for fresh water and a substantial volume of wastewater and other liquid wastes. Furthermore, it is certainly true that as activity levels at SFIA rise in the future both its freshwater requirements and its liquid waste effluents will increase in volume also. The magnitudes of these volume changes are of significant and legitimate concern to the community and, therefore, they are considered in this EIAR.

Future levels of fresh water requirements and liquid waste volumes at SFIA will increase virtually the same way whether or not the proposed expansion project is undertaken. As stated previously, these increases are not the consequences of the proposed project but are rather the by-products of a growing and prospering Bay Area. However, the proposed project does include provision for improved wastewater treatment facilities, which would not materialize if it were not constructed. Thus, the project will in fact result in some beneficial impact in water quality. The detailed assessment of water requirements and wastewater generation is presented in Volume II, appendix E of this EIAR. The results of this assessment are highlighted below.

(1) Water Usage and Supply

SFIA receives its water from the San Francisco Water Department. The projections of the general water usage in metropolitan San Francisco indicate that the present airport requirements represent about one percent of the total system demand. This percentage requirement will not significantly change as a result of the proposed terminal expansion. Water usage at the airport, assumed to be proportional to the number of passengers handled, will be 2.6 mgd in 1982 and 3.4 mgd in 1990. Peak usage may be as high as 4.0 mgd. in 1982 and 5.2 mgd in 1990. The water supply and distribution systems are estimated to be capable of accommodating peaks up to 7.5 mgd, and therefore, are adequate.

(2) Wastewater Generation and Control

The wastewaters generated by SFIA operations fall into three categories:

- Sanitary wastes
- Industrial wastes, for example, the wastes from aircraft maintenance operations, aircraft washing and automobile washing
- Storm runoff

The present collection system does not differentiate between the industrial wastes and storm water runoff at least in most areas. The following paragraphs describe sanitary waste treatment, industrial waste treatment, storm runoff, and hydrological considerations.

1. Sanitary waste treatment

The sanitary sewage system at SFIA consists of a number of gravity collection sewers, pumping stations, and a common force main. (A secondary activiated sludge treatment facility has been in operation at SFIA since August of 1970.) The plant is a typical activated sludge treatment facility with anaerobic sludge digestion followed by vacuum filtration. The treated effluent is presently being discharged to the joint South San Francisco-San Bruno outfall which in turn discharges to the San Francisco Bay about one mile off shore.

The sanitary waste treatment plant serves the entire SFIA facility. The plant currently treats approximately 0.9 mgd, and is expected to have a wastewater load of 1.1 mgd by 1982 and 1.6 mgd by 1990 due to increased passenger growth. The anticipated increase in sanitary waste volumes can be handled by the present sanitary treatment plant which is designed to treat 2.2 mgd average daily flow and can absorb upsets of 3.3 mgd peak hourly flow and 4.4 mgd peak hydraulic flow.

2. Existing Industrial Waste Treatment

The tenant-owner relationship at the airport provides that each tenant is responsible for collecting all industrial waste generated in his own area, with the exception of the passenger terminal area and some cargo areas. The tenant must construct all buildings and pipelines and may connect to the airport's drainage systems at only one point. The

terminal buildings are constructed by the airport to the tenants' specification. The tenants are required to comply with airport regulations which provide for the location and nature of their operations and the quality and method of disposal of their wastes.

The industrial waste produced in shops and service hangars is handled in one of three ways: isolation, separation, or treatment.

The tenants maintain oil and waste collection tanks. Concentrated wastes such as used crankcase oil, paint thinners and cleaning solvents are isolated at the source and collected for ultimate disposal off the airport site by a scavenger contractor. This method, if properly and diligently followed, eliminates the waste from the collection system.

On pipelines which lead away from known sources of industrial waste which cannot be isolated, such as outdoor steam cleaning points, hangar floor gutters and aircraft washing areas, the tenants maintain gravity oil and grease separators. There are many different sizes and types of separators being used and their ability to separate wastes varies considerably. They all have the basic problem of short detention periods and require frequent cleaning. The efficiency of many of the separators is hampered by the fact that the oil and grease is held in suspension by strong detergents. Waste from the separators is disposed in waste collection tanks, while the effluent drains into the storm drain system.

Some of the airlines and related industries have wastes which are of a nature that they may not be discharged without pretreatment. The treatment plants for these wastes are primarily designed for oil and grease removal except for the United Airlines Maintenance Base which is more extensive. All of the pretreatment plants are currently under study because of the need to comply with the airport's relatively new waste discharge regulations.

All the industrial wastewater, except that from several sources which are not connected to the airport storm sewer system, is pumped into the existing North

or South Oxidation Ponds during dry weather. During wet weather, the flow in excess of pump capacity to the oxidation ponds is diverted and discharged directly to the Bay. The diverted flow is a mixture of storm water and industrial waste water.

The two existing oxidation ponds are designated as the South pond and the North Pond. The South Pond has a capacity of approximately 2,300,000 gallons which provides about 15 days of detention time for dry weather flow from the south area. The capacity of the North Pond is approximately 15,600,000 gallons and provides 16 days detention for industrial waste from the north and northeast areas.

The industrial wastewater collected by the existing storm drainage system is transported to channels where pump stations are located. When the flow reaches a predetermined elevation, the pumps are activated and the wastewater is pumped into the ponds. While the wastewater is being held in the channels, the oil floats to surface and the solids settle to the bottom of the channel until it rains. Then the accumulated oil, along with a portion of the settled solids, is flushed to the Bay.

Oil and grease are further separated from the wastewater in the pond. However, without any skimming mechanisms, the floating oil is swept by the wind across the pond, onto the banks and some drifts over the weir and to the effluent pump station. The oil is seldom pumped from the wet well until there is a storm. Most of the suspended solids in the wastewater settle in the pond. However, the algae growth in turn creates suspended solids which appear in the pond effluent and contribute to the effluent BOD. If the two oxidation ponds were to remain in service, provisions would have to be made for removal of oil and algae. However, even then, heavy metal removal would possibly remain a problem.

There does exist the potential for improper handling of industrial wastes. This includes failure by airport tenants to observe good housekeeping practices, accidental or deliberate dumping of oily or toxic wastes, and improper maintenance of oil and grease traps. The airport management has tried to ameliorate the situation in various ways:

- Educational programs with tenants

- Repeated warnings to tenants to observe good management practices for their oil and grease facilities

- More recently, a vigorous monitoring program

3. Proposed Industrial Wastewater Treatment Facilities

An industrial wastewater treatment system is an element of the expansion program at SFIA. This system will meet the most stringent requirements of waste discharge to San Francisco Bay. In addition, the outfall of the treated industrial wastes will be moved one mile offshore (as is the case at present for treated sanitary wastes.) The industrial wastewater treatment facilities would include:

- An equalization pond of one million gallons capacity, incorporating some skimming device to remove oil.

- Oil separators for the removal of easily separated oil.

- Separators for the dispersed oil, including addition of acid, ferric chloride or alum.

- Some form of chemical treatment for heavy metals removal.

- A biological final treatment, preferably a biofilter for removal of phenols and other organic substances.

In addition, it is proposed that the present sanitary and planned industrial wastewater treatment facilities be subjected to additional combined treatment. The elements of the joint treatment system would be:

- A biological oxidation treatment (nitrification) for the reduction of the ammonia nitrogen concentration of the effluents down to the expected discharge requirements of less than 6 milligrams per liter.

- A final filtration step to reduce the suspended solids concentration to below the expected discharge requirement of less than 8 milligrams per liter.

- A chlorination-dechlorination unit to disinfect the effluent. (This would completely overcome the problem of excessive fecal coliform counts, even in the case of accidental or deliberate diversion of aircraft sanitary waste to the industrial sewers.)

After the joint treatment stage, the combined effluents would be discharged approximately one mile out into the Bay by way of the San Bruno outfall:

4. Storm Runoff

The proposed SFIA terminal expansion complex will not result in significant increases in total impervious surface area since the development will basically be on land already paved. Thus, no significant effect on storm runoff is anticipated.

The proposed segregation of industrial wastes would result in an improvement of the quality of the early portions of runoffs, since the chances of washing out accumulations of concentrated wastes in common sewers would be reduced.

5. Hydrological Considerations

The water table in the area of SFIA is approximately 5 feet above sea level in wet winter months and drops several feet during the dry summer months.

Numerous past construction projects at SFIA have indicated that construction affects the water table very little. For instance, the soil in the North Terminal foundation excavation is relatively impermeable. The amount of water entering the foundation excavation was extremely small. The drawdown effect of the seepage into the excavation, although not measured, could not have been great even in the vicinity of the excavation,

and would not have been discernible at any location off the airport. Since the North Terminal foundation required as large an excavation as any of the facilities would require in the entire terminal expansion, the effect of the excavation on lowering the water table is expected to be negligible.

* * * * *

In summary, the following conclusions can be drawn in regard to the probable impact of the proposed terminal expansion on water quality.

- The water requirements of the airport, which are independent of the decision to proceed or not to proceed with the project, will not significantly affect the community, nor overtax the present water supply and distribution systems.

- The anticipated increase in sanitary wastes, which are independent of the decision to proceed or not to proceed with the project, can be handled by the present airport sanitary wastewater treatment plant.

- The proposed new industrial wastewater treatment facility will result in a beneficial impact in terms of the quality of the waters discharged to San Francisco Bay. The heavy metals discharge would be greatly reduced, the oil and grease would be controlled and the adverse impact of potential improper disposal of aircraft sanitary wastes would be eliminated.

- Additional facilities will not significantly increase the paved area over present conditions and thus should have no significant effect on storm runoffs.

- Additional facilities will not significantly affect the hydrological conditions at the site.

6. GEOLOGICAL ASPECTS

The San Francisco area is one of the most active geological areas in the United States. There have been more than a dozen damaging earthquakes in the Bay Area counties during the last century, and it appears reasonable to expect a great earthquake (comparable to the San Francisco earthquake of 1906) to occur once in sixty to one hundred years. The general area of SFIA, including the proposed terminal expansion site, is situated on depressed segmented rock wedged between two uplifted fault blocks which are associated with the complex San Andreas Fault System. The major geologic effect of concern at SFIA is earthquake damage, although tsunamis, or seismic sea waves, are of some concern also.

An airport is a responder to rather than an inducer of geological phenomena. However, airports are relied upon to remain functional after a disaster, such as an earthquake, to provide a base for logistics and communications for the support of relief operations. Thus, the question of probable environmental impact of the SFIA terminal expansion is valid in the sense that the airport's ability to respond from disasters can play a major role in the viability of the local community.

The background and supporting information for assessing the potential effects of earthquakes and tsunamis on SFIA are provided in detail in Volume II, Appendix F, of this EIAR. The results of this assessment are presented here in summary form.

The existing buildings at SFIA are relatively low structures and incorporate design and engineering principals consistent with the current philosophy which is to minimize life hazard and to limit property damage in the event of a great earthquake. The structures to be constructed under the expansion program reflect the state-of-the-art, and therefore are consistent with the same philosophy incorporated in the existing facilities.

Based upon a report prepared in 1972 by the U.S. Office of Engineering Preparedness, the National Oceanic and Atmospheric Administration found that in the event of a major earthquake on the San Andreas Fault, the expected damage patterns would be as follows:

- A magnitude 8.3 shock would close SFIA for a period of weeks. (Metropolitan Oakland International, Alameda Naval Airbase and Hamilton Air Force Base would be shut down for less than a week). Practical land access would be cut off due to highway damage.
- A magnitude 7.0 shock would close SFIA for several days. (Others would be operational shortly after).
- A magnitude 6.0 shock would leave all airports operational within a few hours.

A major earthquake on the Hayward fault would be expected to have the following results:

- A magnitude 8.3 shock would close down SFIA for less than a week (Metropolitan Oakland International and Alameda Naval Airbase would be non-operational for a period of weeks. Hamilton Air Force Base would be operational within a week).

- A magnitude 7.0 shock would not close down SFIA. (MOIA and ANA would be closed for several days).

- A magnitude 6.0 shock would delay operations for only a few hours..

According to the Department of Interior, United States Geological Survey, a twenty foot tsunami wave may arrive at the Golden Gate once every 200 years. In the unlikely event of a large tsunami inundating the airport, the extended portion of runway 28R would likely be flooded. The public areas would not be affected by the tsunami runup, therefore, the tsunami effect on the development and the hazard cost would be small.

7. WILDLIFE, MARINE LIFE AND CONSERVATION AREAS

San Francisco Bay provides an almost ideal environment for a large variety of fish and wildlife. The estuarine environment includes areas of marshlands, salt flats, mud flats and shallow open waters, and so can support this diverse population. Human benefits from the fish and wildlife from the Bay involve food, income, recreation, scientific research education and an environment for living. Although no comprehensive estimate of the value of these benefits has been made, there is no question but that they provide substantial public benefit and must be maintained for both present and future generations of California.

The background and supporting information for assessing the probable effects of the proposed SFIA terminal expansion on wildlife, marine life and and conservation areas are provided in Volume II, Appendix G. The results of the assessment are presented here in summary form.

Since the proposed expansion program is to take place within the confines of the present airport, little impact on the fish and wildlife of the Bay Area is expected. The opinion of the U.S. Department of Interior and the California Department of Fish and Game were solicited in this regard, and these organizations concur that the effects of the expansion program should be minimal. (The responses of these agencies are presented in Volume II, Appendix G, Exhibits G-8 and G-9.) It should be noted that since it is anticipated that the number of aircraft operations is expected to decline slightly from current levels during the period under study, there should be a reduction in whatever effect on wildlife (such as aircraft noise) may be attributed to total operation.

Bay filling is <u>not</u> an element of the SFIA expansion program. The preliminary plan included filling of the Seaplane Harbor and providing roads and facilities in this area, however this element has been deleted from the expansion program. In addition, as previously described in Section 5 of this chapter, wastewater entering the Bay as generated by SFIA operations would be of much higher quality in future years because of improved wastewater treatment facilities included as part of the proposed project.

In summary, the probable impacts can be highlighted as follows:

- The proposed expansion program would not interfere with important wildlife breeding, nesting or feeding grounds.
- The proposed expansion program may provide some beneficial impacts on marine life, and water conservation areas as a result of improved quality of wastewater discharge.

- The proposed expansion program would not alter, destroy or interfere with any wildlife refuge, or water fowl conservation areas.

- The proposed expansion program would not alter the pattern of behavior for a species.

These findings are based primarily on the fact that the proposed expansion will take place within the confines of the existing airport.

8. FUEL AND ENERGY

A detailed assessment of the energy impact of the proposed SFIA development is presented in Volume II, Appendix G, and is highlighted here in summary form. The impact is examined in terms of the consumption of aviation fuels, natural gas and electrical power for operation of facilities, and gasoline for vehicular traffic accessing the airport. Fuel and energy consumption levels were determined for 1982 and 1990 under two different assumptions, for example, with and without the proposed development, and compared with the 1974 base year. These projections were made in order to quantify the probable impact of the proposed terminal complex expansion.

The results of the energy impact assessment are summarized below with respect to aviation fuel consumption, natural gas and electrical power for operation of facilities and gasoline for airport related vehicular traffic.

(1) Aviation Fuel

Total consumption of aviation fuel at the airport during 1973 was approximately 628 million gallons. It is estimated

that aviation fuel consumption will increase by 21 and 30 percent for the planning years 1982 and 1990, respectively. However, on a gallons per passenger basis, there will be a corresponding decrease of 21 and 31 percent for 1982 and 1990 in comparison to 1973 consumption. The reduction in per passenger consumption of fuel can be attributed to the operation in future years of higher efficiency aircraft, for example, the new wide body commercial jet aircraft. The impact of aviation fuel consumption will be the same whether or not the proposed project is implemented, since aviation demand will be the same in either case.

(2) Natural Gas and Electrical Power

Natural gas and electrical power is distributed to SFIA and to its tenants by the Pacific Gas and Electric Company (PG&E). The existing Central and South Terminals are heated by natural gas. The heating plant for the two terminals is located in the south building. Electrical power is consumed by lighting, air conditioning and numerous other facilities.

Current consumption of natural gas and electrical power at SFIA is estimated to be 138 million cubic feet per year and 135 million kilowatt-hours per day, re-

spectively. The proposed SFIA expansion involves construction of a new North Terminal, and expansion of the present South and Central Terminals, as well as the expansion of the parking garage and construction of an industrial waste treatment plant. These elements will significantly increase the natural gas and electrical power consumption of the airport. The table below summarizes the probable impact of the proposed project on the consumption of natural gas and electrical power.

Year	Airport Configuration	Natural Gas Consumption	Electrical Energy Consumption
1974	Existing	138 MCF	135 Mkwh
1982	No Further Development	138	170
	Proposed Development	350	630
1990	No Further Development	138	170
	Proposed Development without BART	350	630
	Proposed Development with BART	350	640

MCF = Million cubic feet per year.
Mkwh = Million kilowatt-hours per year.

It should be noted that there will be some increase in electrical energy consumption in future years even without the proposed project due to improvements not related to the SFIA expansion program. These include improvements in runway lighting, expansion of the airport hotel, improvements of cargo facilities and additional drainage pumping stations.

The levels of energy consumption noted in the table on the previous page represent less than one percent of the total regional consumption.

(3) Gasoline for Airport Related Vehicular Traffic

Gasoline consumption by vehicles accessing the airport relates to the total vehicle miles of travel (VMT) accrued by vehicles traveling to and from the airport. Since total passengers served at SFIA will be the same with or without the project, the resultant VMT will be identical for either case. Thus, there will be no significant difference in gasoline fuel consumption with or without the project.

Current fuel consumption by airport related motor vehicles will increase by approximately 18 percent to about 78 million gallons per year. By 1990, the fuel consumption by motor vehicles will depend on whether or not the proposed

transit link is accomplished. Fuel consumption is estimated to be 75 million gallons per year if the BART link is implemented, and 80 million gallons per year if it is not. The total fuel consumption by airport-related motor vehicles does not increase in the same proportion as VMT because of assumed improved fuel consumption efficiency.

* * * * *

The probable energy impacts associated with activities at SFIA in future years, both with and without the proposed development are depicted in Exhibit II-18. The impacts can be summarized as follows:

- Aviation fuel consumption will be practically the same whether or not the proposed project is implemented.1/ Although fuel usage will increase in future years, energy consumption will be more efficient due to greater use of wide body commercial jet aircraft.

- Energy consumption at SFIA for the operation of facilities, for example natural gas and electrical power, will increase in future years by about 25 percent due to facilities development not related to the expansion program. If the proposed development is implemented, the requirement for natural gas for heating will increase nearly two and one-half times and the requirement for electrical power for lighting, etc., will increase approximately four times the existing demand.

- Gasoline fuel consumption for airport-related vehicular activity will be practically the same whether or not the proposed project is implemented.1/ The use of BART coupled with more fuel efficient motor vehicles will lessen the impact of the expected increase in VMT due to the rising volume of air passengers at SFIA through 1990.

1/ There would be some increase in fuel consumption by aircraft and access vehicles as a result of increased idle time if the project is not implemented.

EXHIBIT II-18

San Francisco International Airport

SUMMARY OF ENERGY IMPACT

FUEL AND ENERGY CONSUMPTION (TBY) [1/]

Year	Airport Configuration	Aviation Fuel	Natural Gas	Electrical Power	Automotive Gasoline	Total	Percent Increase Over 1974
1974	Existing	74	0.15	0.5	7.6	82.2	--
1982	No Further Development	89	0.15	0.6	8.7	98.4	20
	Proposed Development	89	0.35	2.1	8.7	100.2	22
1990	No Further Development	96	0.15	0.6	9.2	105.9	29
	Proposed Development without BART	96	0.35	2.1	9.2	107.7	31
	Proposed Development with BART	96	0.35	2.2	8.6	107.2	30

1/ TBY = Trillion BTU's per year.

9. SOLID WASTE MANAGEMENT

Many airports across the nation are developing into major commercial complexes which have the same problems of development as other urban institutions. One of these is the disposal of the solid wastes, i.e., the metal, paper, plastic, wood and food wastes generated by human activities. SFIA is somewhat unique in its position with respect to the greater Bay Area Community which surrounds it on three sides. Whereas other airports may have open land surrounding them, SFIA is itself surrounded by communities and San Francisco Bay. This fact imposes more stringent requirements on it for disposing of its wastes in a manner compatible with the rest of the community.

The background and supporting information for assessing the potential effects of the proposed expansion program on solid waste management are provided in detail in Volume II, Appendix G. The results of this assessment are presented here in summary fashion.

Functionally there are four major activity centers at SFIA which generated solid waste:

- The passenger terminals of which there are currently two. A new North Terminal is a part of the expansion program.
- The air freight and air mail handling facilities of which there are two major areas incorporating eight buildings.
- The aircraft service centers of which there are six major areas with several buildings per area.
- The aircraft maintenance base.

Currently, approximately fifty tons of solid waste are generated at SFIA each day. This quantity constitutes less than two percent of the total solid waste generated in San Mateo County.

The current disposal practice is to place solid wastes in a sanitary landfill at Menlo Park. This site is expected to have a viable life of six to eight more years after which it is planned that it will be developed into a park. Beyond that, an additional site, Ox Mountain, is under consideration for the future. The airport will cooperate with local and regional agencies in planning for use of alternative sites.

In addition to the wastes generated by passenger and cargo related activities, some solid waste is generated by other activities such as construction, and demolition. Wood materials from such activities are usually disposed of outside the airport in the sanitary landfill. Dirt, broken asphalt and concrete are used as landfill at appropriate areas on the airport.

As previously mentioned, the passenger and aircraft operations levels will rise whether or not the expansion program is implemented. Given this fact, the impact on solid waste quantities and management will be the same whether or not the terminal expansion program is implemented.

In summary, SFIA's should not be the source of unmanageable solid waste disposal problems. The present solid waste load is about two percent of the county total and should remain at this percentage over the period under consideration.

10. AESTHETIC AND VISUAL EFFECTS

Although SFIA is adjacent to San Francisco Bay, which is an area of unique interest and scenic beauty, the project will not impact upon the Bay in a negative manner. The scenic view available to those outside the airport should not suffer serious deterioration since the development under the expansion program will take place within the confines of the present airport.

Since its inception, SFIA has traditionally been a fully developed aviation complex. The proposed expansion program will complete this concept. Completion of the North Terminal and parking garage will provide an improved symmetry of overall design. The buildings have been designed to be architecturally compatible with the current airport terminal buildings. The new rotundas and connecting corridors will be designed to be primarily functional in facilitating the transfer of passengers to the other areas of the terminal complex. The entire complex, when completed, will provide an aspect of an integrated whole. The overall design compatibility and integrity is to be achieved by placing the architectural responsibility of the expansion program under the aegis of a single firm.

In addition, the expansion program provides for $850,000 for landscaping by plantings of trees and shrubs primarily along the main access, which should enhance the general aesthetic character of the airport.

11. RECREATIONAL, CULTURAL AND HISTORIC AREAS

In its present configuration, SFIA imposes some impact on nearby recreational, cultural and historic areas. This impact is basically limited to noise exposure from aircraft operations. As previously indicated, noise exposure from SFIA operations is expected to decline in future years due to a quieter fleet of aircraft and slightly fewer total operations. This condition will result whether or not the expansion program is implemented.

From the detailed analysis provided in Volume II, Appendix G, the probable impacts (with or without the project) can be highlighted as follows:

- For the years 1974 and 1982, no parks or recreation areas fall within the State of California noise incompatible land areas for residential use (save one which may do so during the seasonal period). In 1990, six parks will, at all times, fall within the noise contour then applicable to residential use. It should, however, be emphasized that these same parks will be on land which would have been compatible with residential use for the previous planning years. The implication of this is that by 1990, the use of the residential criteria to assess recreational land use becomes too conservative. Obviously, the use of land for recreational purposes need not have as strict a requirement as residential land use.

- SFIA, even in its present configuration, has little impact on historical sites. In the 1982 and 1990 planning years, since the noise contours are shrinking, this situation is improved to the extent that no historic site is within any of the contours.

Since the proposed expansion program is to take place within the confines of the present airport, it can be further concluded that the project will not disrupt, alter or destroy any recreation areas, public parks, cultural

area or historic site, and would not involve the development of any open land that has historical, archaeological or paleontological significance.

12. COMPATIBLE LAND USE, COMMUNITY DISRUPTION AND RELOCATION OF PERSONS

The proposed project will have no impact in any of the above areas. The only problems dealing with land use compatibility are related to noise; and, as discussed earlier in this chapter, the noise effects will occur whether or not the proposed project is implemented. There will be no community disruption resulting from the project because no land acquisition is necessary. For the same reason, there will be no need for relocation of persons.

13. ECONOMIC AND SOCIAL EFFECTS

Two categories of socio-economic impacts should be assessed in evaluating the expansion program. First, the capital cost should be weighed against the expected improvements in facilities and conditions. Second, ancillary socio-economic effects such as employment and expenditures should be considered.

The $390 million capital cost of the expansion program will permit the maintenance of a reasonable terminal sizing/passenger ratio throughout the forecast period. As noted in Volume I, Chapter I, the ratio of boarding passengers per square foot of space would increase to an untenable level by 1990; thus, the expansion program is necessary to maintain the viability of SFIA as the Region's major air carrier facility if levels of service are not to deteriorate significantly.

With regard to ancillary socio-economic effects, e.g., employment, income, and expenditures, the tremendous impacts of SFIA upon the Bay Area are illustrated in Chapter IX and in Volume II, Appendix H. While it must be conceded that many of these impacts are functions of air transportation demand and not direct results of the expansion program, it must also be noted that the expansion program will enhance the position of SFIA as a major employer and economic influence in the region.

14. PROJECT CONSTRUCTION EFFECTS

The major construction activities for the proposed expansion program where environmental quality may be a problem would include changing the existing terrain for automobile parking and aircraft parking; installing crushed rock under areas to be paved with asphalt; paving with asphalt; paving with Portland cement concrete in certain aircraft parking areas; and construction of the terminal structures.

The construction materials for these activities would be obtained from existing suppliers, quarries, and asphalt plants in the area. The contractors would be required to operate in accordance with existing pollution control methods. Provisions will be included in the construction specifications to ascertain that the criteria for environmental controls during construction are met. Recommendations from the FAA Advisory Circular AC 5370-7, Airport Construction Controls to Prevent Air and Water Pollution, would be included. The contractor would be required to maintain all excavations,

embankments, haul roads, access roads, plant site, waste disposal areas, borrow areas, and all other work areas within or without the project limits free from dust that would cause a hazard to the work or to persons or property.

Construction access would be by existing public roads. Large trucks and heavy construction equipment would be prohibited from using the main access road unless there is no other feasible route.

The emission of smoke, dust, or other air pollutants from asphalt plants, rock quarries, concrete plants, and other construction equipment is under the control of the Bay Area Air Pollution Control District, which issues permits for such equipment when the equipment is in conformance with their requirements.

Noise would be generated by construction of the proposed facilities. Freeway traffic and aircraft operations have effectively "masked" any construction noise in this area in the past. The major portion of the expansion is east of the Bayshore Freeway, approximately 3,000 feet from residential areas. Construction work is normally accomplished during daytime hours from 7:00 a.m. to 4:30 p.m.

Water that has to be pumped out of any construction area will be routed to the existing storm drain system. The storm drain system has two detention basins where solids and large contaminants are settled out before the water is discharged to the Bay.

CHAPTER III

PROBABLE ADVERSE ENVIRONMENTAL EFFECTS WHICH CANNOT BE AVOIDED IF THE PROJECT IS IMPLEMENTED

CHAPTER III

PROBABLE ADVERSE ENVIRONMENTAL EFFECTS WHICH CANNOT BE AVOIDED IF THE PROJECT IS IMPLEMENTED

The preceding chapter examined the probable impacts on the environment in light of two basic premises.

- Conditions that would prevail if no development action were taken at SFIA
- Conditions that would prevail if the proposed SFIA terminal expansion were implemented

As previously mentioned, the decision to proceed or not to proceed with the proposed project will not effect the level of demand imposed on the facility throughout the planning period under investigation. Since the demand levels would be the same, the probable impacts on many of the environmental areas of concern will be identical whether or not the project is implemented.

In general, with respect to the decision to proceed or not to proceed with the proposed project, the probable impacts have been shown to fall into three categories:

- The resultant impacts will be the same without implementation of the project
- The resultant impacts will be beneficial if the project is implemented.
- The resultant impacts will be adverse if the project is implemented.

Exhibit III-1 on the following page, summarizes the probable impacts in terms of the above three categories. As indicated, there would be an adverse impact on increased energy consumption if the proposed project is implemented. The increased energy would consist of increases in natural gas and electrical power consumption as a result of the terminal complex expansion. Further examination of Exhibit III-1 indicates that for five of the areas of concern, namely ground access, air pollution, water pollution, aesthetics and socio-economics, implementation of the project will result in beneficial impacts over that which would exist if no further development takes place. Furthermore, for the remaining six areas listed, noise exposure, geology, wildlife, solid waste, recreational and historic areas, and compatible land use, there would be no difference in impact whether or not the project is implemented. It should be noted, however, that according to California law, there will be an adverse effect regarding compatible land use whether or not the project is implemented . Since the California compatible land use criterion becomes stricter in the future (80 CNEL for 1974, 70 CNEL for 1982 and 65 CNEL for 1990) the number of incompatible residential acres increases over the years. For the same reason, (i.e. progressively more stringent criteria), the number of people and dwellings within residences in areas of incompatible land use increases also. Because no federal guidelines have been developed for ASDS applications, it can only be noted that the total area exposed decreases in the future, with or without the proposed program.

EXHIBIT III-1

San Francisco International Airport

SUMMARY OF PROBABLE
IMPACTS ON THE ENVIRONMENT

ENVIRONMENTAL AREA OF CONCERN	SUMMARY OF PROBABLE IMPACTS		
	No Difference In Probable Impact With or Without Project Implementation	Probable Impact Will Be Beneficial If Project is Implemented	Probable Impact Will Be Adverse If Project is Implemented
Noise Exposure	X 1/		
Ground Access		X 3/	
Air Pollution		X	
Water Pollution		X 3/	
Geology	X		
Wildlife, Etc.	X		
Energy			X
Solid Waste	X 3/		
Aesthetic		X	
Recreational Historic Areas	X		
Compatible Land Use and Community Disruption	X 2/		
Social and Economic		X	

1/ Noise exposure will improve from existing conditions whether or not project is implemented.

2/ Incompatible land area will increase in future years (adverse effect) whether or not project is implemented, because of more stringent California noise criteria in future years.

3/ Solid waste quantities, water usage, waste water volumes, and ground vehicle movements will increase whether or not the project is implemented.

There would be unavoidable increases in solid waste generation, water usage, wastewater generation and ground vehicle movements, all of which can be considered to be adverse impacts. However, these impacts will result whether or not the project is implemented.

During project construction there would be unavoidable environmental impacts of a temporary nature. These impacts would be manifest mainly as noise, air and water pollution. Measures would be taken to minimize these temporary effects.

In summary, there would be few unavoidable adverse environmental impacts as a result of implementation of the proposed project. On the contrary, if the project is implemented, ground access, air quality, aesthetic and socio-economic conditions would be better than conditions which would prevail if no development action were taken.

CHAPTER IV

ALTERNATIVES TO THE PROPOSED PROJECT

CHAPTER IV

ALTERNATIVES TO THE PROPOSED PROJECT

In assessing the environmental impacts of a proposed project, it is necessary to consider what alternatives might be available. In the case of SFIA expansion, these alternatives may be grouped into two broad categories:

- No further increase of activity levels at SFIA
- Continuing increase of activity levels at SFIA

The assumption that there is to be no further increase of activity levels at SFIA does not mean that growth of transportation demand in the Bay Area is expected to stop. Rather, it means that the rising demand of transportation demand must be accommodated through development of new airports, use of other airports or alternate modes of transportation. If, on the other hand, growth of activity continues at SFIA, it may be accommodated by the existing facilities or by expanded facilities.

The remainder of this chapter deals with these five alternatives in sections entitled:

- Use of Other Airports or Alternative Sites
- Alternative Modes of Transportation
- No Further Development of SFIA
- Improve the Present Site

1. USE OF OTHER AIRPORTS OR ALTERNATIVE SITES

The Regional Airport System Study (RASS) Committee developed a number of alternatives for use of existing Bay Area airports and potential new sites. Considerable effort was expended in evaluation of such alternatives in the RASS, and was not duplicated in this study. 1/

In 1970, the RASS Committee proposed eleven alternative combinations of airport locations and capacities. These were based on demand information produced in the Bay Area Study of Aviation Requirements (BASAR), and contemplated different levels of activity at each of the existing Bay Area airports and some new airports. Each of the eleven preliminary alternatives was designed to satisfy the BASAR forecast except for one, which assumed full capacity on existing runways at the three major airports and fell short of the forecast demand. These alternatives and their respective demand distributions are shown in Exhibit IV-1.

Several additional alternative airport locations were suggested after about a year of committee work with the preliminary alternatives. These were:

- A new regional mid-Bay airport on 2,000 acres of new Bay fill
- A new regional airport in eastern Contra Costa County, and

1/ For further details of the evaluation of alternatives, see Regional Airport Systems Study, Final Report; Association of Bay Area Governments; June, 1972.

EXHIBIT IV-1
San Francisco International Airport
RASS ALTERNATIVES

Alternatives	Airport	Million Annual Passengers	Annual Operations
1.	San Francisco International	32.7	424,000
	Oakland International	34.3	446,000
	San Jose Municipal	16.5	259,000
Total		83.5	1,129,000
2.	San Francisco International	37.9	492,000
	Oakland International	24.1	313,000
	San Jose Site "E" (new)	21.5	279,000
Total		83.5	1,084,000
3.	San Francisco International	32.7	424,000
	Oakland International	13.8	179,000
	Hollister (New Airport)	30.8	400,000
	Hamilton AFB	2.7	41,800
	Buchanan Field	2.4	37,400
	Livermore Airport	1.2	18,600
Total		83.5	1,100,800
4.	San Francisco International	32.7	424,000
	Oakland International	13.8	179,000
	San Jose Municipal	7.5	117,000
	Travis AFB	29.5	384,000
Total		83.5	1,104,000
5.	San Francisco International	37.9	492,000
	Oakland International	22.0	286,000
	San Jose Municipal	16.5	259,000
	Sonoma County Airport	2.7	41,800
	Richmond (New Airport)	4.4	68,600
Total		83.5	1,147,400
6.	San Francisco International	32.7	424,000
	Oakland International	17.0	221,000
	San Jose Site "E" (new)	33.8	440,000
Total		83.5	1,085,000
7.	San Francisco International	32.7	424,000
	Oakland International	8.8	115,000
	San Jose Site "E" (new)	42.0	546,000
Total		83.5	1,085,000
8.	San Francisco International	32.7	424,000
	Oakland International	13.8	179,000
	San Jose Municipal	7.5	117,000
	Napa County	2.7	43,000
	Hollister (New Airport)	26.8	349,000
Total		83.5	1,112,000
9.	San Francisco International	32.7	424,000
	Oakland International	43.3	563,000
	San Jose Municipal	7.5	117,000
Total		83.5	1,104,000
10.	San Francisco International	32.7	424,000
	Oakland International	24.1	313,000
	San Jose Municipal	16.5	259,000
	Napa County	10.2	133,000
Total		83.5	1,129,000
11.	San Francisco International	32.7	424,000
	Oakland International	13.8	179,000
	San Jose Municipal	7.5	117,000
Total		53.9	720,000

- A new major airport in Marin County, with the option of using Hamilton AFB as a major air carrier facility

From this point, the RASS Committee proceeded with detailed technical studies of the aeronautical, economic, and environmental impacts of the alternatives under consideration. More than 30 public meetings of the Committee were held during this process, and five designated public hearings produced more than 600 pages of testimony from speakers representing diverse public and private interests. Based on public response, eight possible new airport locations were eliminated from active consideration because it was concluded that each would have serious negative impacts in areas of air quality, Bay fill, or growth inducement.

The final selection of a preferred alternative for the Region was principally accomplished through judgmental evaluation and a process of elimination. Following are the key considerations leading to the recommended regional airport system:

- Based upon an airfield capacity analysis the practical capacity of SFIA was around 31 million on and off passengers. This was established as a limit for growth at SFIA.
- For environmental reasons, it was concluded that San Jose should limit growth of its airport at a level of ten million passengers. Beyond that point, excess traffic would be handled by SFIA and Oakland.
- Travis AFB was felt to be too remote, and would not likely be used unless it offered some unique service. Moreover, capital costs for access and terminal facilities would be quite high.

- Oakland was chosen as the most logical site to fulfill overflow demand from San Jose and San Francisco. Oakland's accessibility and its over-water noise abatement advantages strengthened this conclusion.

- Other airports (Napa or Hamilton) would serve local needs rather than regional needs.

Based on these conclusions, regional demand was allocated as shown in Exhibit IV-2. From the exhibit, it can be seen that expansion of SFIA was not selected as a substitute for expansion of the other area airports but all must expand to satisfy their assigned regional role.

This proposed development staging for the area airports was updated in RASS in June, 1972. There have been some modifications to this plan since that time, the most notable of which is the revised RASS passenger forecasts released in December, 1974, depicted in Exhibit IV-3. However, none of these changes represented a modification to the ultimate level of growth at SFIA -- 33 million total passengers (in and out).

2. ALTERNATIVE MODES OF TRANSPORTATION

Several alternative modes involving new technology have been suggested and studied in the past, principally including high-speed ground transportation, short take-off, and landing (STOL) aircraft, and offshore airports. Each could lead to substantial environmental benefits in certain applications. Each, however, presents substantial capital requirements and/or technological feasibility problems, as discussed below.

EXHIBIT IV-2

San Francisco International Airport

RASS ALLOCATION OF BAY AREA DEMAND

Passenger Levels, in millions of on and off passengers

AIRPORT	1975	1980	1985	Runway Change
San Francisco	19	23	31	none
Oakland	6	13	24	new runway
San Jose	3	6	10	extended runway
Travis	0	1	6	new runway
Hamilton/Napa	0	1	1	extended runway at Napa only
TOTAL	28	44	72	

Note: Both Exhibits IV-2 and IV-3 relate only to airfield improvements required to accommodate projected aircraft operations at these passenger levels. Additional support facility improvements (e.g., terminal, access, parking, etc.) are required to satisfy forecast demand.

EXHIBIT IV-3

San Francisco International Airport

ALLOCATION OF BAY AREA DEMAND
(RASS II MODIFIED FORECAST)

Passenger Levels, in millions of on and off passengers

AIRPORT	1975	1980	1985	Runway Change
San Francisco	16-17	22-23	26-29	none
Oakland	2.5-3	3-4	8-9	new runway
San Jose	2.5-3	4-5	6-7	extended runway
Other	0	0	0-1	
TOTAL	21-23	29-32	40-46	

(1) High Speed Ground Transportation

This alternative was considered by RASS as a viable mode for "California Corridor" [1/] traffic, but not as an operational system until after 1985. Reduction in total regional air traffic growth may result from such a system, but major public commitments of land and capital would be required and high travel densities would be necessary for economical operation. This proposal is still under study, and will bring no relief to SFIA within the foreseeable future because of the time required for implementation and serious technological problems.

(2) STOL

RASS recommended continuing review of this alternative for specific applications, and noted the noise abatement potential as a primary environmental advantage. Although there is a demonstrated technological capability to produce STOL aircraft, there is presently no major producer of STOL aircraft, primarily for cost-competitive reasons and because there has been no demonstrated market. As with high speed ground transportation, the time required to develop and market STOL aircraft offers little hope for immediate relief at SFIA.

1/ "California Corridor" is Los Angeles, Sacramento and San Francisco.

(3) Offshore Airports

This alternative is comparable to the mid-Bay alternative studied by RASS. The environmental advantages pertain to noise and, possibly, to air quality. Serious disadvantages include extremely high capital costs and very difficult access problems. This alternative is not considered viable to meet air travel needs of the Bay Region within the time frame under consideration.

3. NO DEVELOPMENT OF SFIA

Another alternative would be simply to halt further development at SFIA. In fact, an integral part of this study was an evaluation of the conditions that would occur if no development action were undertaken -- called the "do nothing" condition. To assess the impacts under this condition, it was necessary to consider what effect there would be on activity at the airport if the proposed program were not implemented.

The first point of consideration in this question lies in the effect on the level of aircraft activity. The proposed expansion program is designed to accommodate expected increases in wide-bodied aircraft operating at SFIA. It might seem reasonable to assume that if the program were not implemented, it would deter the carriers from operating the desired number of wide-bodied aircraft at SFIA.

This is not likely to occur to an extent that would produce a measurable effect. There are two reasons for this:

- Air carrier scheduling decisions tend to be motivated by market and fleet inventory considerations rather than by consideration of the facilities available at any single station.

- The air carriers have demonstrated that they will "make do" when faced with less than ideal facilities at an airport provided only that the facilities' deficiencies are not so severe as to absolutely prohibit operation of certain aircraft types. Examples of this are Atlanta and Chicago, where there is a significant shortage of facilities. In spite of such disadvantages as extreme delays and severe degradation of service to passengers, the carriers have elected to "make do" rather than curtail their activities.

Consequently, it is unlikely that a decision not to implement the proposed program would affect the fleet (or numbers) of aircraft serving San Francisco Moreover, in view of the fact that no airfield improvements that might boost capacity are contemplated, a "do nothing" decision would not affect airside delays -- another possible deterrent. It should be noted that there would be an increase in ground delays to aircraft because of a shortage of adequate gates to service them. However, these delays would have little or no effect on the level of activity or its growth.

Another question to be considered is the impact of a "do nothing" decision on passenger activity. As the proposed program does not involve any major improvements to the airport access system, the "do nothing" case would not produce ground access conditions that would not otherwise pertain.

Therefore, access would be no more a deterrent to passenger activity without the proposed project than it would be with the project. As mentioned earlier, though, unless the project is implemented there would be a deterioration (perhaps severe) in ground service to passengers. This problem would manifest itself in a marked increase in congestion at the curb front, crowding within the terminal areas themselves and inconveniences in terms of access to the aircraft.

However, none of these factors have much bearing on passenger demand, which is instead very strongly based on local economics, the cost of travel, the number of multiple city-pairs served by air and the proximity of the airport to the air passenger market. Professional travelers (business people) go because they must and select the airport with the best air service which is in reasonable proximity to their origin or destination; pleasure travelers give little thought to anything other than cost when deciding whether or not to fly. SFIA satisfies these passenger demand requirements and will continue to do so in the future.

It was therefore concluded that a "do nothing" decision would not affect the character or volume of activity at San Francisco International Airport. The cause and effect characteristics are more a function of economic variables than facility availability. Consequently, the forecasts adopted for this condition were the same as those used to assess the impact of the proposed program.

Throughout this study, the proposed program was compared with "do nothing" conditions. The results of these comparisons are described in detail in Chapters II and III of this report, as well as in Appendices B, C and D of Volume II. They are highlighted below:

- Noise: The noise impact of the proposed program is the same as would occur if the expansion program were not implemented.
- Access: Ground access problems will be more severe if the proposed program is not implemented. (See Chapter II.)
- Air Quality: Air quality problems will be more severe if the proposed program is not implemented. (See Chapter II.)

Moreover, as discussed in Chapter II, severe crowding and congestion problems will occur in the terminal building, at its curb front and in parking areas if the expansion program is not implemented.

For these reasons, it was concluded that a "do nothing" decision would be an undesirable choice.

4. IMPROVE THE PRESENT SITE

The proposed expansion program could be considered as only one of a number of ways to improve the present site. While this is certainly true, it should be pointed out that development of the proposed program was a process that involved detailed evaluation of a large number of alternatives. This evaluation was designed to produce a smoothly operating, efficient facility that would accommodate the projected demand without undue capital cost. Moreover:

- As has been shown earlier, the environmental effects of the proposed program result in a net improvement over the environmental effects that would otherwise ensure.

- Any properly designed expansion program would have similar costs with the same level of environmental improvement, because its design would satisfy demand -- something the existing facility does not do.

Consequently, any major effort to consider alternative ways to expand existing facilities would provide only minimal changes.

5. SUMMARY

It has been determined that despite the availability of other airports, SFIA must expand to accommodate regional passenger demand and to satisfy its assigned regional role. Other alternative modes present substantial capital requirements and/or technological feasibility problems which dismiss their applicability in the time frame under consideration. The "do nothing" decision is an undesirable choice as ground access conditions would be poorer, air quality problems will be more severe, and the crowding and congestion in the terminal, at curb front and in parking areas would also be severe. The proposed expansion program, improving the present site, is compatible with the findings and conclusions of previous plans which indicate SFIA must expand to satisfy the need for meeting regional passenger demand requirements, and is the most feasible in the short term.

In conclusion, expansion of the present site was determined to be the most viable, from a planning and economic standpoint. The proposed SFIA development does not derogate the environment but a decision not to proceed with the program would result in derogation.

CHAPTER V

RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF THE ENVIRONMENT AND MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

CHAPTER V

RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF THE ENVIRONMENT AND MAINTENANCE AND ENHANCEMENT OF LONG TERM PRODUCTIVITY

As described in other sections of this report, long-range projections for air travel demand indicate substantial increases in facilities requirements in the region. The RASS study undertook to determine how best to provide these facilities giving full consideration to economic, environmental, access, and other concerns. The RASS decision to allocate 31 million annual passengers (on and off) to SFIA is therefore supported by long-range regional goals and policies.

Since the proposed terminal complex expansion would take place entirely within present boundaries, the short term uses of the natural environment would be minimal. The short term effects of construction, such as dust generation, noise pollution, and additional drainage, will be controlled by appropriate measures included in the construction specifications. The construction specifications will include all applicable measures to comply with Federal, State and local air, noise and water pollution regulations.

The proposed project includes modifications to present terminal buildings, replaces existing boarding areas, and adds additional passenger terminal facilities, all designed to better accommodate the forecast changes in fleet mix which will carry substantially greater numbers of passengers per aircraft. This will permit more efficient use of the existing airport land area, and will accommodate the forecast requirement of nearly twice present levels without the need for additional acreage.

The proposed SFIA terminal complex expansion is anticipated to satisfy the demand for passenger travel through 1990. It is quite possible that shortly thereafter travel demands will increase beyond the capacity which this expansion would accommodate, however, it is not planned to further expand SFIA beyond the capacity to handle 31 million annual passengers (on and off). By that time, rapid transit corridors such as between San Francisco and Los Angeles, may become realities in which case the increased demand for long route air travel could be offset by reductions on the short routes. Furthermore, by that time STOL aircraft may be developed to the point where they can be economically operated along the short routes. In any event, for the foreseeable future, the facilities in this project will be needed for the efficient accommodation of air travelers, and filling this need would enhance the long-term productivity of the airport.

As a result of the changing aircraft fleet mix, aircraft retrofit programs, and aircraft and motor vehicle emission controls, noise and air pollution will be reduced throughout the planning period below levels experienced today. These measures - while independent of the proposed program - should enhance the environment while making the use of the existing facility more productive.

Finally, as a result of the inevitable increases in air passengers at SFIA, there will be a corresponding increase in the number of motor vehicles accessing the airport. The proposed program includes provisions for additional curb

frontage and parking facilities, which will enhance the operational efficiency of motor vehicles accessing the airport. Also, the proposed program has provisions for accommodating BART if it is extended to the airport. However, it is projected that a BART link to SFIA would reduce only five percent the number of vehicles accessing the airport.

CHAPTER VI

IRREVERSIBLE OR IRRETRIEVABLE COMMITMENTS OF RESOURCES

CHAPTER VI

IRREVERSIBLE OR IRRETRIEVABLE COMMITMENTS OF RESOURCES

Implementation of the proposed SFIA terminal complex expansion would require the commitment of the following resources:

- Construction materials for building structures, building interiors, and apron and taxiway pavement.
- Natural gas and electrical power for heating, lighting and cooling the expanded terminal complex.
- Manpower for construction.
- Capital.

The expenditure of these resources in the implementation of the project would be irreversible.

Potential beneficial impacts attributable to the proposed SFIA terminal expansion would include the ability of the facility to better provide public service, reduced on-airport congestion of ground access traffic, reduced air pollution, improved wastewater treatment, enhanced aesthetics over present conditions, and enhanced socio-economic conditions for the area and business community. Potential adverse impacts attributable to the proposed project include increased consumption of natural gas and electrical power for heating, lighting and cooling the new facilities.

In the interests of future users of the facility, the factors of health, safety, and natural resources will not be materially changed. It is true that increased energy resources will be consumed by the project; however, any other alternative proposed for accommodating the increased air travel demand would consume resources of a comparable level.

CHAPTER VII

PROBLEMS AND OBJECTIONS RAISED BY OTHER FEDERAL STATE AND LOCAL AGENCIES AND CITIZEN GROUPS

CHAPTER VII

PROBLEMS AND OBJECTIONS RAISED BY OTHER FEDERAL, STATE AND LOCAL AGENCIES AND CITIZEN GROUPS

As of this date, no problems, objections, or comments have been received regarding this Environmental Impact Assessment Report. Comments directed toward this report will be incorporated when the public information/hearing process begins.

The previous Environmental Impact Report submitted by the San Francisco City Planning Commission was the subject of many comments, both favorable and unfavorable. The EIR was circulated only through the State level and did not reach any Federal reviewing agencies. The sections below summarize those comments. A complete transcript of all problems, objections, and comments regarding the EIR submitted by the San Francisco City Planning Commission is on record at 100 Larkin Street, San Francisco.

(1) Problems and Objections of Agencies and Groups

Exhibit VII-1 lists the agencies and groups responding to the original EIR.

In general, the unfavorable comments were directed at aviation forecasts, alternatives, growth inducement, ground traffic, air and noise pollution, and mitigating measures. The main thrust of the comments was directed toward a general lack

EXHIBIT VII-1

San Francisco International Airport

LIST OF AGENCIES AND GROUPS
RESPONDING TO ORIGINAL EIR

Director of Airports, William J. Dwyer
ABAG, Mr. Borte
San Francisco Ecology Center
William M. Brinton
International Association of Machinists and Aerospace Workers
Air Transport Association
San Mateo County Development Association, Inc.
Maurice A. Garbell, Inc.
San Francisco Convention & Visitors Bureau
City of San Bruno
Consolidated Flower Shippers, Inc.
Betty Rader
Environmental Impact Planning Corporation, H. Feibusch
San Francisco Tomorrow - Susan Smith
Gil Bailie
Construction Workers of San Mateo - Robert Gilmore
Sierra Club - Sally Cooper
Loma Prieta Chapter, Sierra Club - E. Larson
Friends of the Earth - Hastings Environmental Law Society
San Mateo County Convention and Visitors Bureau
G. Paulson Hetter, M.D.
San Francisco Tomorrow
Corps of Engineers
Division of Highways
Sierra Club - Marjorie Evans
City of Millbrae
Department of Transportation Letter to San Francisco Tomorrow
League of Women Voters of San Mateo County
The City of Burlingame
Peninsula Manufacturers Association
Environmental Quality Coordinating Council
Mrs. Rose Urbach
County of San Mateo, Planning Department

of objectivity and adequacy of the original analysis. The favorable comments were concentrated in the area of the economic impact of the airport relative to the San Francisco Bay Region.

(2) Comments From A-95 Review

The Association of Bay Area Governments (ABAG) is the local A-95 reviewing agency. ABAG's final review of the previous EIR (dated September 27, 1973) indicated that the proposed airport expansion program was in compliance with the recommendations of the Regional Airport Systems Plan (RASS). ABAG has commented again on the airport expansion program as recently as July, 1974.

The comments in the July report were concentrated in five areas:

- Air Travel and Allocation
- Airport Access
- Aircraft Operations and Load Factors
- Noise
- Air Quality

The report concludes that San Francisco International Airport should maintain its position as the lead airport in the Bay area in terms of diversity of services offered and volume of traffic and that expansion to 31 million annual passengers (on and off) is not an

unreasonable ultimate passenger level for SFIA. Various recommendations were made to insure that the expansion program met the RASS decision criteria used in evaluating airport systems. The major recommendations were:

- Each stage of the SFIA expansion program should be reviewed separately in light of experience to determine the need for additional facilities.

- A study should be performed in cooperation with the regional airports and airlines to determine the geographic location of demand in the Bay area for the major air markets.

- Expansion of the Oakland and San Jose airports to bring these airports up to their passenger handling potential and to help relieve congestion at SFIA.

- A plan should be prepared outlining an alternative transportation system to that of BART. Major elements of this plan would be:

  - expanded bus service

  - differential landing and/or automobile parking fees to encourage off-peak airport usage

  - better shift staggering

  - programs to instigate employee carpooling

- The Airport should act further to minimize ground vehicular emissions. These actions would include provisions or inducements for transit/common carrier service in addition to existing airport transit and the possibility of BART.

- A more detailed description of the air quality monitoring system including:

- identification of the location of the air quality monitoring stations.

- a definition of "dangerous air pollution levels", at which point the "protective action" program will be implemented.

- a definition of all steps to be taken during the "protective action" program.

- an identification of the "appropriate local agencies" and their powers and responsibilities, with regard to "protective action".

. The Airport take corrective measures if it violates State noise regulations and that these measures be specified.

CHAPTER VIII

MITIGATION MEASURES PROPOSED TO MINIMIZE THE IMPACT

CHAPTER VIII

MITIGATION MEASURES PROPOSED TO MINIMIZE THE IMPACT

The RASS Committee reviewed the overall environmental impact on the San Francisco Bay Area and concluded that expansion of SFIA to accommodate 31 million air passengers (on and off) would most effectively mitigate the regional impact. This is true mainly since SFIA is already more accessible than the other area airports and can have an expanded capacity without acquisition of land and a minimum creation of new incompatible land use areas.

The proposed SFIA terminal complex expansion in turn incorporates a number of significant measures to mitigate the impact on the local environment. The areas for which proposed mitigation measures have been developed include:

- Noise exposure and land use
- Ground access
- Air pollution
- Water pollution
- Fuel and energy consumption

The mitigating measures proposed for each of the above areas are described separately below. It should be noted that the proposal mitigating measures do not include those which are not a function of the proposed project. For example, aircraft retrofit programs for reduced noise and air pollutant emissions and automotive emission controls will likely be instituted whether

or not the proposed project is implemented. While these measures will help the abatement of environmental impacts, they cannot be claimed as mitigation measures stemming from the proposed project.

1. NOISE EXPOSURE AND LAND USE

Community exposure to aircraft noise, in future years, at SFIA will be reduced below existing levels. There is not difference between the noise impact of the "do-nothing" alternative and the noise impact of the proposed terminal complex development alternative. Thus, the proposed development program would not produce any degradation in community noise environment that would not otherwise occur if the development program were not implemented. Therefore, measures to mitigate noise pollution caused by the development action are not required since no such pollution is anticipated.

However, the management at SFIA has taken steps to lessen the noise exposure situation. These include:

- Lengthening of runway 28R, which makes possible right turns short of San Bruno Mountain on takeoffs to the west, thereby reducing the number of flights that must fly through the "Gap" over South San Francisco.
- The FAA and SFIA have examined the possibility of routing flights farther to the east, maximizing of over water approaches.
- SFIA is in the process of installing a continuous noise monitoring system which will provide definitive identification of noise impacted areas.
- A Sound Abatement Center was established to begin dialogue between the noise impacted residents, SFIA and the airlines.

- Two segment approaches are commonly used by one airline to date.

- Visual Bridge Approach - places the approach to runway 28 farther from Foster City under visual conditions.

- Quiet one SID - departures from parallel runways 1 proceed up the Bay to reach higher altitudes before flying over populated areas.

Land use control options as a mitigating measure at SFIA have not been fully explored as an option for inclusion in this EIAR, and for good reasons. Due to the extreme urbanization and residential development that has occurred close to the airport over the years, the cost of implementing widespread land use control, i.e., acquisition of impacted areas would be prohibitively expensive at this point in local development. This is not to say, however, that land use control actions have not or cannot be taken. The Airport Staff and the Airport's Commission have taken and will continue to take action in this area. Previous actions have included coordination with various local and regional planning agencies involving zoning activity and land use compatibility with present and forecasted airport operations. As a result, proper zoning laws have been enacted relative to height restrictions and land use and the appropriate public agencies give full consideration to airport plans in their studies for area development. The scale to which these measures can be implemented and their utility in mitigating future conditions is limited, however, based on existing land uses.

In summary, positive benefits in noise reduction can and will accrue to the residents near SFIA. These benefits are more a function of time, various regulatory agencies, and private industry and not a function of the proposed airport development program.

2. GROUND ACCESS

An evaluation of alternative highway improvements was undertaken to determine possible mitigating measures required to improve the overall levels of service in the three analysis areas of on-airport intersections, off-aircraft intersections and off-airport highway utilization.

(1) On-Airport Intersections

The ground access analysis assumed the signalization of the intersections of R1 and R18, R3 and R18 and R3 and R6, as well as the widening of R3 to four lanes with a separate left-turn lane at its intersection with R6.

Under the highest traffic loading occurring in 1990, the only intersection operating over capacity (by 400 vehicles) is the intersection of R3 and R18. The primary reason for the operational breakdown at this intersection is the extremely high volume (over 1,000 vehicles in 1990) of left-turning vehicles from R3 to R18. As a form of mitigation, the construction of a two-lane jughandle for this movement (through the existing parking lot and opposite the R18 approach) would enable the operation of the intersection to improve to level of service A in 1982 (previously D), and level of service D in 1990 (previously F).

(2) Off-Airport Intersections

The future impact assessments have assumed the completion of I-380, linking the Bayshore Freeway with the Junipero Serra Freeway (I-280), the reconstruction and expansion of the Bayshore Freeway from the airport interchange north to the I-380 interchange, as well as the widening of Old Bayshore Road to allow for a double left-turn lane at its intersection with Millbrae Avenue.

The redistribution of traffic through the intersection of San Bruno Avenue and South Airport Boulevard in 1990 shows an operating level of service F (over capacity). For mitigation, it is recommended that the reconstruction of San Bruno Avenue take place to provide for separate left-turn lanes at the intersection to improve the overall level of service to level B (stable flow) in 1990.

(3) Off-Airport Highway Utilization

The analysis of the off-airport utilization has assumed the network improvements previously stated and the widening of two airport interchange ramps from one to two lanes (southbound ramp to airport and northbound ramp from airport).

The southbound airport interchange ramp from the airport will operate over capacity during the 3 to 4 P.M. peak hour in 1982 and over capacity for all three analysis hours in 1990. It is recommended that this ramp be widened from one to two lanes to increase the level of service during the highest hourly volume to level B in 1982 and level D in 1990.

The northbound airport interchange ramp to the airport will operate over capacity during the 3 to 4 P.M. and 5 to 6 P.M. peaks and at capacity during the 7 to 8 P.M. peak. If is recommended that this ramp be widened from one to two lanes to increase the level of service to level B for all three analysis hours in 1990.

3. AIR POLLUTION

Specific mitigating elements related to minimizing adverse air quality impacts include the following:

- The increased curb frontage afforded with the North Terminal addition will result in improved traffic flow, less idle time, and generally less congestion. As a result, air quality conditions would be improved over that which would exist if no further development takes place.
- The terminal improvements and increased number of aircraft gates will result in reduced aircraft idle time while at apron areas. This element will also result in improved air quality over that which would exist if no further development takes place.
- The SFIA expansion program makes provision for a direct BART connection to facilitate transit access and reduce dependency on auto travel for passengers and employees. This element would reduce airport-related VMT, and thus reduce air contaminant emissions and improve local air quality.

Other mitigating measures include those proposed by airport management to encourage the reduction of contaminant emissions generated on the airport. These measures include enforcement of motor vehicle idle times while at terminal curbfronts, reduced off-airport parking rates to encourage the use of remote parking areas, and enforcement of minimizing aircraft idle times while parked at apron gates.

4. WATER POLLUTION

As a means of mitigating potential water pollution problems, the expansion program incorporates a complete industrial wastewater treatment system. The industrial waste treatment system will meet the most stringent requirements of waste discharge to the San Francisco Bay waters. Therefore the quality of the effluent entering the Bay would not only be improved, but would be more effectively dispersed into deeper waters.

5. FUEL AND ENERGY

As a means of mitigating the increased demand of the proposed new facilities for fuel and energy, the program provides for integrated heating, cooling, and electrical systems to maximize efficiency of fuel and electrical power utilization.

CHAPTER IX

GROWTH INDUCING EFFECTS OF THE PROPOSED ACTION

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The need for expansion of facilities at SFIA follows from the assignment (through recommendations contained in the RASS study) to SFIA of the primary responsibility for meeting forecast air transportation demand in the Bay area. As noted in Chapter I, the expansion program is needed to maintain reasonable service levels in the face of a near doubling of air passengers to be served by SFIA during the study period.

Data provided in Volume II, Appendix H, of this report indicate that increased air passenger demand at SFIA will induce substantial increases in employment during the study period. The anticipated increases over 1975 levels are:

- 1982 -- 7,218 employees
- 1990 -- 13,055 employees

The analysis of growth inducing effects of the expansion program proceeded from the assumption that these increases are primarily attributable to the increased demand for air transportation. The effects of these increases were then assessed on the basis of criteria advanced in various technical documents prepared in support of the RASS as well as the draft Environmental Impact Report prepared for the expansion program. These technical reports include:

- Wilsey and Ham, The Effect of Aviation on Physical Environment and Land Uses, 1971.

- William Goldner, et.al., Economic and Spatial Impact of Alternative Airport Locations, 1971.

The draft EIR contained data derived from reports by Wilsey & Ham, and Goldner, et.al., which showed that a ratio of 1.25 local service employees was required for each basic employee in the Bay area. Thus, the addition of approximately 13,000 airport-related employees during the study period would be expected to generate approximately 16.4 thousand local serving employees. The combined addition of these airport-related and local-serving categories would total 29.4 thousand.

The draft EIR also produced data showing that each job was anticipated to add approximately 1.5 persons to the region's population and that each three (3) persons added to the population generated the need for one residence. Applying these coefficients to the airport-related and local-serving employment increases produces a projected population increase of 44.1 thousand and an associated increase in residences of 14.7 thousand by 1990. On the basis of four (4) residences per acre, the residential land requirement would be approximately 3,675 acres by 1990.

These increases in residences and population would produce increases in demand for public services and utilities. Based upon the residential distribution of present airport-related employees, this burden would rest upon San Mateo County (approximately 51 percent), San Francisco County (17 percent), Alameda County (13.7 percent) and Santa Clara County (9.8 percent).

The demand for utilities created by this probable addition of people and residences would be on the order of 75 million kilowatt hours per year of electricity and over 2,000 therms of gas. Water requirments (based upon 130 gallons per day per person) would be 5.7 million gallons per day. Assuming 90 percent of usage as waste water generation, 5.2 million gallons per day of sewage would be generated.

Accompanying these increased demands would be increased tax payments. Based upon ratios developed in the studies cited above, property taxes by 1990 for example, are estimated to be $15,312,500 per year.

The keys to successfully accommodating such growth lie in effective community planning and local public administration. The data provided in this and other sections of this report are key inputs into the planning and administration process.

CHAPTER X

BIBLIOGRAPHY

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1. A Digital Computer Program for Computation of Noise Exposure Forecast Contours, Bolt, Beranek and Newman, June, 1970.

2. Air Quality Implementation Plan Development for Critical California Regions, Prepared for U.S. EPA, TRW, Inc., July, 1973.

3. Air Transport Association of America, Interview with representatives.

4. Airport Capacity Handbook, Airborne Instruments Laboratory, (AIL), June, 1969.

5. Assumptions for CNEL Contours at San Francisco International Airport, Wyle Laboratories, July 10, 1973.

7. Bay Area Air Pollution Control District, Aviation Effect on Air Quality in the Bay Region, February, 1971.

8. Bay Area Air Pollution Control District, Contaminant and Weather Summary, January, 1973 through October, 1974.

9. Bay Area Air Pollution Control District, Information Bulletin, June 15, 1970.

10. Bay Area Air Pollution Control District, Lead Concentrations in the San Francisco Bay Area, 1970-1973, August, 1974.

11. Bay Area Air Pollution Control District, Loc. cit. p. 2.

12. Bay Area Air Pollution Control District, Source Inventory of Air Pollution Emissions in the San Francisco Bay Area, 1973

13. "Bay Area Air Pollution Control District, 1968: An Agricultural Burning Program Derived from Inversion Climatology in the San Francisco Bay Area", Information Bulletin, November, 1968.

14. Bay Area Pollution Control District, Loc. cit., p. 3.

15. Bay Conservation and Development Commission, The Bay Plan, 1969.

16. Bay Conservation & Development Commission loc. cit.

17. BCDC Board of Consultants, "The Safety of Fills," California Division of Mines and Geology. Special Report 97, 1969.

18. Beck, R.W. & Associates, Master Utilities Plan and Electrical Systems Study, at San Francisco International Airport for Airport Commission, City and County of San Francisco, 1972.

19. Beck, R.W. & Associates, Ibid. Appendix.

20. Bedore, L.P., National Business Aircraft Association, Inc. "NBAA Noise Abatement Programs" March, 1973

21. Bell, G.B., DeMarrais, G.A., and Holzworth, G.C., 1963: Temperature Inversion Summaries of U.S. Weather Bureau Radiosonde Observations in California. (MS of U.S. Weather Bureau and California Dept. of Public Health).

22. Board of Airport Commissions, Los Angeles International Airport, "Resolution No. 7467 - A Five Point Plan for Airport Noise Abatement," December 20, 1972

23. Buonaccorsi & Associates to San Francisco Airport Architects, Private Communication, March 31, 1975.

24. Capacity of Airport Systems in Metropolitan Areas, Methodology of Analysis, Airborne Instrument Laboratory (AIL), January, 1964.

25. Carmichael, R.E.L., Pacific Southwest Airlines, "Regarding PSA Policies Involving Noise Abatement During Arrivals and Departures, March, 1973

26. Consoer, Townsend & Associates, Preliminary Design Study - Industrial Waste Treatment and Collection Facility, 1973

27. Consoer, Townsend & Associates, Supplemental Preliminary Design Study - Industrial Waste Treatment and Collection Facilities, 1974

28. Council on Environmental Quality, Fourth Annual Report, p. 78, September, 1973

29. Cruz, J.E., "Aircraft Sound Description System," FAA Report No. FAA-EQ-73, March, 1973

30. Department of Aeronautics, Title 4 - Subchapter 6 - "Noise Standards", State of California

31. Department of Interior, U.S. Geological Survey, Atlas of Urban and Regional Change, San Francisco Sheets: 150-525, 175-550, 150-550, 125-550, 150-575, 125-575, May, 1970

32. Dixon, R., Speas Associates, Airport and Airspace Capacity Analysis, Bay Area Study of Aviation Requirements, Pg. 4-14, May, 1970

33. Duckwork, F.S., and Sandberg, J.S., "The Effect of Cities on Horizontal and Vertical Temperature Gradients," Bull. Amer. Meteorol. Soc. 35, pp. 198-207, 1954.

34. Environmental Protection Agency, Loc. cit.

35. Environmental Source Service Administration, Climate of California, Climatography of the United States, 60-4, Silver Springs, Md., 1970.

36. EPA, Compilation of Air Pollutant Emission Factors, AP-42, Second Edition, and Supplement, April, 1973 and September, 1973

37. EPA, Review and Analysis of FAA Noise Regulation NTID 73.6, July, 1973

38. Federal Aviation Agency, Airport Construction Controls to Prevent Air and Water Pollution," April, 1971

39. Goldman, H. "Geology of San Francisco Bay". Geologic and Engineering Aspects of San Francisco Bay Fill, California Division of Mines and Geology, Special Report 97, 1969

40. Goldman, H. Ibid, p. 15

41. Ham and Wilsey, The Effect of Aviation on Physical Environment and Land Uses, 1971, p. VI - 25.

42. Ham and Wilsey, op. cit. p. VI - 32

43. Jenson, W.A., Airport Transport Association of America, "ATA Flight Operations Committee Recommended Takeoff Procedures - Effective Date 1 August, 1972", June, 1972

44. Jeppeson Airway Manual

45. Lee & Praszker, Soil and Foundation Exploration Proposed Expansion of San Francisco International Airport, Airport Bond Fund, 1967, April 21, 1969

46. Lee & Praszker, Soil and Foundation Exploration, Proposed Expansion of San Francisco International Airport, Airport Bond Fund, 1967, North and South Terminals, Rotundas and Connecting Corridors, April 21, 1968.

47. Lee & Praszker, Ibid, p. 27, Diagram 3

48. Lee & Praszker, Ibid, p. 2

49. Metcalf & Eddy, Inc., Private Communication, January 1975

50. Metcalf & Eddy, Inc. Report on Analysis of Airport Solid Waste and Collection Systems, 1972.

51. Metcalf & Eddy, Inc., Report to the City and County of San Francisco Airport Commission on Addition and Improvements to the Water, Sewage, Drainage and Gas Systems for San Francisco International Airport, 1970

52. National Oceanic & Atmospheric Administration, A Study of Earthquake Losses in San Francisco Bay Area, U.S. Department of Commerce, 1972

53. National Oceanic Atmospheric Administration, loc. cit., p. 169-170

54. Northern Research and Engineering Corporation, loc. cit.

55. Pacific Gas and Electric Company, Gas Supplies Forecasts, July, 1974

56. Pacific Gas & Electric Company, Prospectus First and Refunding Mortgage Bond Series 74A, p. 15, 1974

57. The Port Authority of New York and New Jersey, Maximum Allowable Landing and Take-off Weights of Aircraft Used Certificated Scheduled Air Carriers at Port Authority Airports, 1975

58. The Potential Impact of Aircraft Emissions Upon Air Quality Northern Research and Engineering Corporation, December, 1971.

59. Preliminary Terminal Area Forecast, provided by FAA representatives

60. Public Law 90-411, "Aircraft Noise and Sonic Boom"

61. Public Law 91-258, Airport Development Aid Program

62. Public Law 85-726, Federal Aviation Act

63. Public Law 91-190, National Environmental Policy Act

64. Public Law 92-575, Noise Control Act

65. Public Law 91-604, Noise Pollution and Abatement Act

66. Regional Airport Systems Study Committee, "Regional Airport" "Systems Study," Final Plan, 1972

67. "Regional Airport System Study," Final Plan, June, 1972

68. Regional Airports System Study, Summary Report, Phase I, ABAG, August, 1970.

69. Robinson, E., 1959: Air Pollution Potential of California Coastal Climate (MS of Bay Area Air Pollution Control District)

70. San Mateo Planning Commission, Private Communication, January, 1975.

71. Seid, H.B., "Seismic Problems," Geologic and Engineering Aspects of San Francisco Bay Fill, California Division of Mines and Geology, Special Report 97, 1967

72. SFIA Engineers to Landrum & Brown, Private Communication, March 28, 1975.

73. SFIA Engineers to Metropolitan Transportation Commission, Private Communication, November 13, 1974

74. South San Francisco Scavenger Company, Private Communications, January 1975

75. State Department of Transportation, Interview with representatives

76. Summary of Series 2 Projections, ABAG/MTC, August, 1973

77. Treasher, R.C., "Geology of Sedimentary Deposits in San Francisco Bay, California," California Division of Mines and Geology, Special Report 82, 1963

78. TRW, Inc., Air Quality Implementation Plan Development for Critical California Regions, Prepared for U.S. EPA, July, 1973

79. U.S. Department of Interior, Geological Survey, Map Showing Areas of Potential Inundation by Tsunamis in the San Francisco Bay Region, California, 1972.

80. U.S. Department of Interior, Ibid

81. U.S. Environmental Protection Agency, "Requirements for Preparation, Adoption, and Submittal of Implementation Plans," Federal Register, p. 15495, Vol. 36 (158), August 14, 1971

82. U.S. EPA, "A Sample Highway Air Pollution Model" (HIWAY), June, 1973